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Editor—VICTOR H. ALLEN

Advertising Manager—DENIS A. COURTNEY

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THE SOCIETY is the growth of over forty years of achievement and leadership. Its members are engineers and technicians skilled in every branch of motion-picture film production and use, in television, and in the many related arts and sciences. Through the Society they are able to contribute effectively to the technical advance of their industry. The Society was founded in 1916 as the Society of Motion Picture Engineers and was renamed in 1950.

Membership in Sustaining, Active, Associate or Student grades is open to any interested person according to his qualifications. Information about membership, technical activities and standards and test films for the industry is available from Society Headquarters.

SOCIETY OF MOTION PICTURE AND TELEVISION ENGINEERS

Headquarters Office: 55 West 42d St., New York 36, N.Y. Telephone: LOngacre 5-0172

Executive Secretary: BOYCE NEMEC

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Progress Committee Report

By LLOYD THOMPSON
Committee Chairman

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Introduction

1955 was not a year of revolutionary change in the motion-picture and television industry. However, it soon becomes evident, especially to anyone working on a report of this type, that it was a busy year and that many new items and improvements were made. Several interesting reports came from countries outside the United States and they are included in rather full detail because for many this will offer the only chance to become familiar with these activities.

Suggestions for the Report on 1956

The Committee Chairman can better organize his instructions to committee members. The instructions for this year caused some duplication of work and confused some as to exactly what they were to do. It is suggested that the committee appointed be notified early in 1956 as to what their duties are to be so they can be collecting material throughout the year. It should be interesting if more reports were received from countries outside the United States of America, such as Mexico, South America, Japan, etc. More than the usual number of pictures are included this year, and it is the feeling of the Chairman that even more would be good — especially of equipment from other countries where reports must be of a limited nature.

Submitted April 6, 1956, by Lloyd Thompson, Committee Chairman, The Calvin Company, 1105 Truman Rd., Kansas City 6, Mo. The Committee makes an annual report, this report covering the calendar year 1955.

Wide-Screen Installations

The committee reported that it was almost impossible to give an exact number on new wide-screen installations made during 1955, and it was also impossible to break these down into individual processes such as CinemaScope and VistaVision. However, in a number of cases it might be said that where wide-screen installations were made, most theaters tried to install screens which would take care of any of the processes, excepting Todd-AO and Cinerama.

Twentieth Century-Fox completed their new 55mm CinemaScope process. Todd-AO opened with their new release of *Oklahoma* at the Rivoli Theatre in New York on October 13. Complete adoption of VistaVision by J. Arthur Rank Organization in England was made in 1955. There was an expanded use of double-frame projection with VistaVision prints. M-G-M demonstrated test footage on their new 65mm anamorphic and/or standard process. A number of people used the SuperScope anamorphic process — that is, the conversion of standard camera negative to anamorphic releases. There was also an expanded use of a conversion of 35mm anamorphic negatives to flat release prints, both 35mm and 16mm, and also a conversion of flat 16mm to 35mm CinemaScope and other such transfers. More theaters equipped themselves, both in this country and foreign countries, with anamorphic equipment.

CinemaScope

During 1955, theater CinemaScope installations increased 6073 and now total 16,428 in the United States and Canada. Of these, 4466 use magnetic reproduction from 4-track prints.

Two theater installations have been made to test the presentation of CinemaScope pictures using sound reproduction from one track of a 4-track release print. As a result, development of low-priced equipment has been promoted and made available to the trade. World-wide there are now approximately 31,500 theaters equipped; an increase of 17,000.

Bausch & Lomb introduced a 16mm, high-quality projection, anamorphic sys-

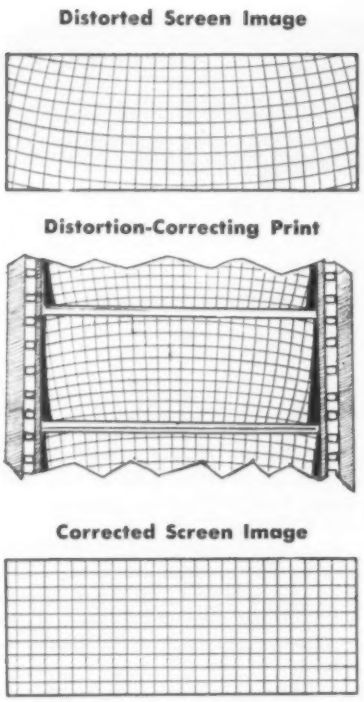

Fig. 1. Method of correcting print to give correct screen image. The top section of this drawing shows how straight horizontal and vertical lines are distorted by keystone and screen curvature. Distorting a print in processing so that vertical and horizontal lines would take the shape shown in the film strip at center could counter-balance this distortion and provide straight lines on the screen shown at bottom even though that screen be curved. These diagrams are not meant to be an exact description of the Todd-AO corrective printing process. Their purpose is to explain in simple language how it works. In addition to the two types of distortion mentioned above, the Todd-AO method also corrects a print for distortion caused by the use of extreme wide-angle lenses in photography.

tem combining the objective lens and anamorphic optics. Abroad, 16mm anamorphic systems were designed and made available world-wide for amateur use.

Twentieth Century-Fox completed an investigation of larger negative films for very high definition images and, as a result, introduced 55.625-mm film with a negative image of four times the area of the 35mm version. This system is completely anamorphic and needed new camera lenses which were supplied by Bausch & Lomb. The latter company produced a combined objective and anamorphic system (similar to that in use on 35mm cameras) with substantial improvement in definition and effective carrying power without apparent image distortion. This photographic method was put into use on two feature pictures, *Carousel* and *The King and I*.

The 55mm system is designed so that, by a variety of processes, roadshow and/or standard 35mm release prints of superior pictorial quality can be produced. In connection with these processes, Bausch & Lomb, from a proposal made by the Research Dept. of Twentieth Century-Fox, developed an original printer illuminating system superior to any method commonly known in the art.

SuperScope

During 1955, the SuperScope process was used on 25 major American motion pictures. At the end of 1955 ten foreign productions were shooting for SuperScope. The new SuperScope 235 anamorphic print which matches the dimensional characteristics of CinemaScope 2.35 to 1 optical sound print was developed by SuperScope during 1955. The compression ratio is 2 to 1.

Todd-AO

Todd-AO with their first picture *Oklahoma* opened at the Rivoli Theatre in New York City on October 13. The United Artists Theatre in Chicago installed Todd-AO equipment and opened the latter part of December. Other installations were to follow in 1956. The Todd-AO projector is designed for 35mm as well as 70mm film, this being done by switching a few parts on the projector. The projector picks up either standard optical sound or CinemaScope magnetic sound or Todd-AO magnetic sound. One of the most interesting refinements of the Todd-AO system is a distortion-correcting printing process developed by Dr. Brian O'Brien of the American Optical Co. The corrective-printing process, which is roughly described in an accompanying illustration (Fig. 1), is designed to eliminate the image distortion that would otherwise be present on a giant, deeply curved screen when projection is from a steep angle. Two classes of prints are to be provided, one to correct for projection angles of from 10 to 15°, and the second for still higher projection angles. The projector head which is manufactured by Philips of Eindhoven in Holland uses Peerless Hy-Candescent condenser arclamps manufactured by the J. E. McAuley Co. of Chicago; they are provided with a new type of water-cooled jacket for the positive carbons (Fig. 2). The projector gets away from conventional design in that the Todd-AO film is projected at 30 frames/sec instead of the usual 24.

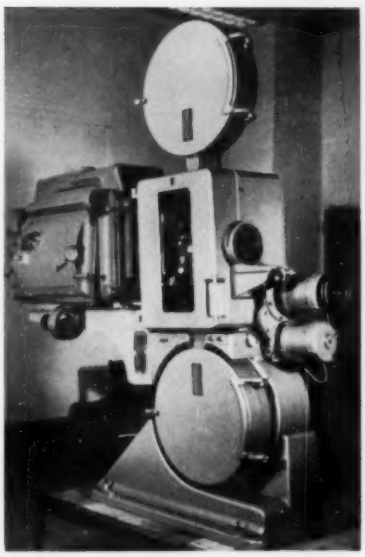

Fig. 2. The Todd-AO projector for both 70mm and 35mm film.

A sound reproduction system which is both complicated and versatile has been designed to reproduce the six magnetic tracks used in the Todd-AO system. The equipment will also accept prints with any type of 35mm sound system now in use. Sound for the performances at the Rivoli Theatre in New York was ob-

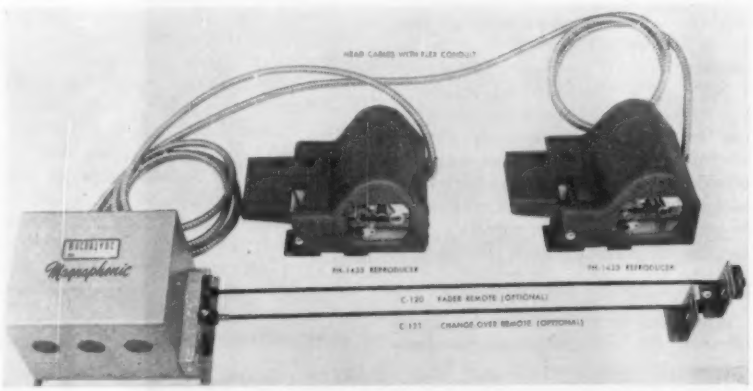

Fig. 3. Magnaphonic C-1 single-channel magnetic sound system. Wall cabinet shown on left contains plug-in amplifier, power supply, adjustable equalization, head-balancing pots, fader, projector change-over and magnetic-optical switch.

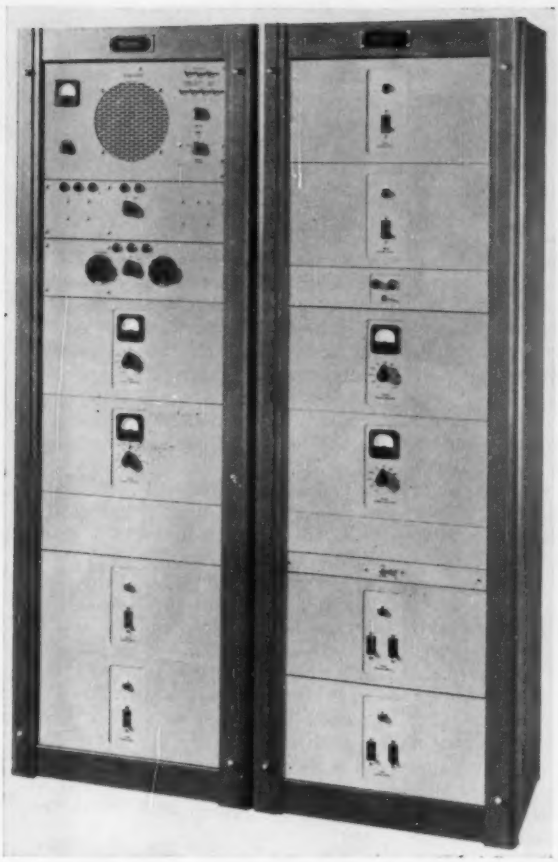

Fig. 4. The Westrex multichannel transmission cabinets for 3- or 4-channel magnetic or photographic reproduction (front view).

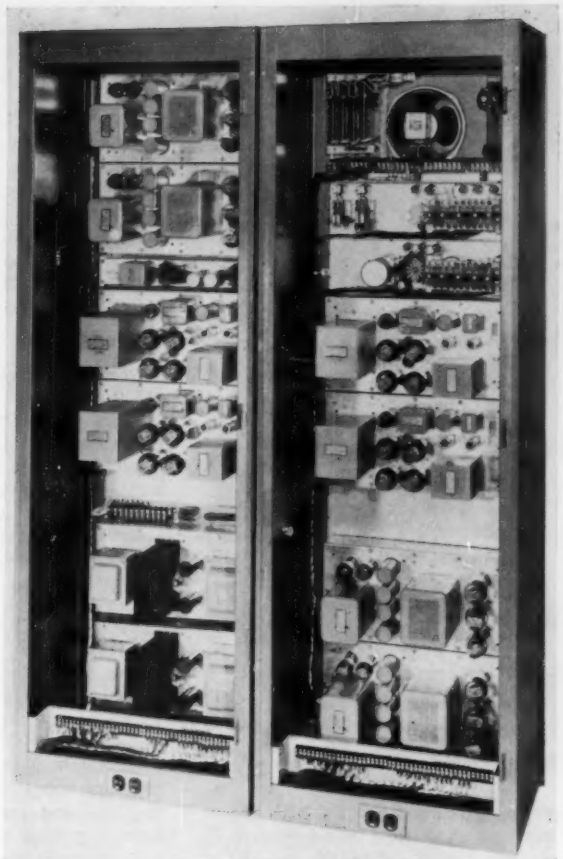

Fig. 5. The Westrex multichannel transmission cabinets for 3- or 4-channel magnetic or photographic reproduction (rear view, hinged doors removed).

tained from a separate sound film which contains six tracks and was synchronized to the projector by means of a selsyn interlock. However, it was expected that the 6-track would be placed on the 70mm film.

The screen used at the Rivoli Theatre in New York is 63 ft wide, 27 ft high, and curves to a depth of 13.3 ft. The chord of the screen (the distance from one edge to the other) is just over 50 ft, presenting viewers with an effective aspect ratio of approximately 2:1. As has been stated, the projector head was made by Philips but the rest of the unit, including lenses, base, magazines and other parts, are produced in the United States by the American Optical Co.[1]

VistaVision

The double-frame VistaVision camera process was used for 28 feature picture productions during 1955. These included 15 features made at Paramount Pictures plus nine made by the J. Arthur Rank Organization, and one each by Sir Alexander Korda, Ponti-DeLaurentiis, Universal-International and Merian C. Cooper. In addition there were six travelogues and shorts produced and two demonstration spectaculars for General Motors. Actively involved in planning at the end of the year were several new users of the process, including M-G-M and Stanley Kramer and visitor demonstration films for Colonial Williamsburg and the Ford Motor Company.[2]

Theater Sound

Magnasync Manufacturing Co. introduced their C-1 theater sound reproduction system (Fig. 3). The system has two prime objectives:

(1) It will give the theater the obvious advantage of magnetic reproduction, such as increased frequency response and proved signal-to-noise ratio.

(2) With the installation of the penthouse reproducers the theater has taken the first important step toward the eventual conversion to standard CinemaScope stereophonic sound reproduction.[3]

Westrex made a number of advances in theater sound equipment. One of the features of the Westrex Corp. 1955 systems is the transmission equipment. Type 36 and 37 equipment cabinets are 6 ft in height and provide for 3- or 4-channel magnetic or photographic reproduction, self-contained monitoring, and nonsynchronous and switching facilities (Figs. 4 and 5). The Westrex 50-w power amplifier delivers more output with less distortion and with the use of less current from standard vacuum tubes than previous 50-w amplifiers. The stage loudspeaker assemblies feature the Westrex Acoustic Lens which assures an even distribution of sound throughout an auditorium with a minimum of interference patterns.[4]

Drive-ins

According to Eric Johnson of the Motion Picture Assn. of America, there are now 7,000 drive-in theaters in this country. During 1955 there was a continual improvement in equipment being offered to them. Among these were:

Improvements in Drive-in Screen Materials. The Committee reports that there have been no new drive-in screen materials developed during the year 1955; however, in 1954 the Research Council developed an all-aluminum drive-in screen surface which provides an increase in picture brightness of approximately 300% to all viewing positions within the drive-in theater. Only three or four such

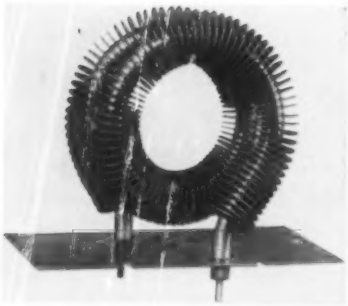

Fig. 6. Calrod heating unit used in RCA Dyna Heat in-car heater.

Fig. 7. Complete RCA in-car heater.

screens were installed in 1954. As of December 1955, there was a total of 20 drive-in theaters using the aluminum screen developed by the Research Council. This screen carries the trade name Manco-Vision screen.

The so-called plastic base paints of the polyvinyl types using a titanium white pigment have received wider usage as a white surface coating for drive-in screens during 1955, and have the advantage of staying white longer and being less susceptible to yellowing in sunlight.[5]

Drive-In Theater Sound. The Circlite Junction Box was introduced during the year. This is comprised of conventional die-cast top and bottom between which is sandwiched a colored translucent Plexiglas band. This band is available in either red, green or white. A single illuminating bulb is within the junction box, which is used both as a post and road light as well as a source of illumination for the translucent band.

A variable tap junction box transformer is available so that voltage drop in long lines may be compensated for. This has been a very useful and very practical tool for overcoming this difficulty in large drive-in theaters.

Projection Equipment. The RCA-200 Projector was introduced with certain improvements, such as higher light-transmitting efficiency shutters, water cooled aperture and clearance for the *f*/1.7 light beam. These units were installed in some of the largest drive-in theaters.

Taller & Cooper Admission Control Equipment. This equipment is very similar to that employed at most of the toll bridges and toll roads of the United States. The cashier indicates the number of patrons in a car and this number is immediately flashed on an illuminated indicator board which is visible to both the incoming patron and to management in exactly the same way that this is done at toll bridge locations. The car proceeds down the lane and runs over a 4-contact treadle. The car count from the lane treadle, as well as the number of patrons in the car, are accumulated within a remote recorder located in the manager's office. Whenever it is desired, a totalizing print giving all essential information relative to transactions in any one of the drive-in theater lanes is immediately available. This printed record is accepted by the Internal Revenue Dept. for tax purposes. Instantaneous records are immediately available in checking number of patrons in the theater so that plans for concession requirements may be accurately made.

RCA Dyna-Heat In-Car Heaters.[6] These heaters employ a calrod heating unit which is supplied with aluminum diffusing fins so that generated heat is made immediately available (Fig. 6). A fan directs cool air over these heat diffusing fins so that the heat is quickly dissipated in the car. Units are available in both 500-w and 750-w capacity to operate from either 208-v or 240-v sources. These units are helping very markedly in materially increasing the length of the drive-in theater season (Fig. 7).

Ballantyne introduced an amplifier for small drive-in theaters known as the KX. It is available in single- or double-channel and is rated at 75-w.

International Projector Corp. introduced a new drive-in speaker with several design advancements. This is a more rugged unit and at the same tin.e it is easier for the user to handle. It has a two-step bracket which allows the speaker to be used on the car windo:v regardless of whether it is up or down. It is also more easily serviced. Figures 8 and 9 show two views of Highway Drive-In Theatre, Bentley Park, Perth, Western Australia.

The one picture shows part of the projection room which features the Westrex 300-w main amplifying system. This cabinet contains ramp switching, power supplies, nonsynchronous amplifier, microphone amplifier and radio tuner. The tuner is for testing speakers, and provides continuous sound from any local broadcasting station while the operator goes around the ramps checking the loudspeakers.

Westrex also reports the opening of

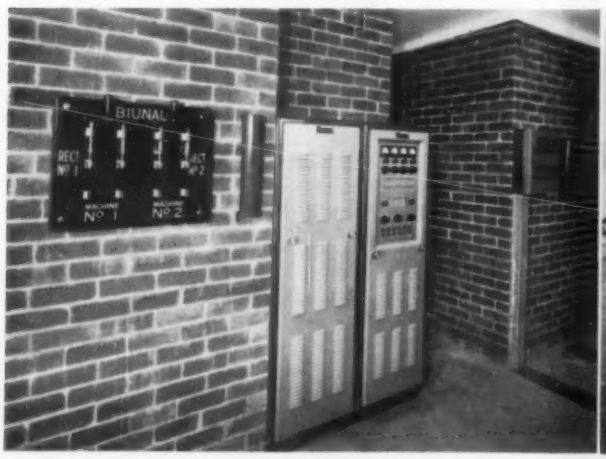

Fig. 8. Projection booth of the highway drive-in theater, Bentley Park, Perth, Western Australia.

Fig. 9. Final stages of construction of the highway drive-in theater, Bentley Park, Perth, Western Australia.

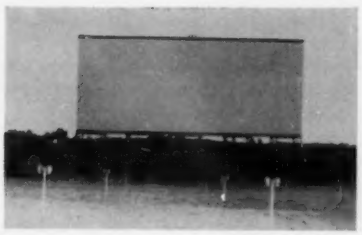

Fig. 10. Velskoen Drive-In Theater—largest screen in Africa. 120 ft wide × 52 ft high; overall height of structure 75 ft; projection throw 375 ft.

two drive-in theaters in South Africa (Fig. 10).[7]

Projection Equipment

A number of improvements were made in projection equipment during 1955; some of these are reported elsewhere in this article.

The International Projector Corp. announced the Simplex XL500 Integrated Sound System designed especially for new theater installations and for modernization of theaters with outmoded optical sound equipment. It provides three- or four-channel magnetic stereo and regular optical sound with maximum simplicity in installation and operation. Every effort has been made to simplify operation of this new sound equipment which is considered essential to reduce the probability of errors arising from multiple controls required by the new processes (Fig. 11).

The Ballantyne "BW" Projector was improved during 1955. The improvements included a new lateral guide roller, a screw which permits adjusting lateral position of film while the projector is in operation. This new adjustment permits projectionists to compensate for a difference in prints from different producers or from one process to another and control image and sound. Also introduced is a new aperture air-cooling intake. The back cover of the "BW" Projector has been redesigned and an air shoot has been cast on the inside of the trap with the shoot exhaust directly at the film trap. By this modernization it has been possible to keep a constant blast of air directly on the film (Fig. 12).

Double-frame VistaVision projection equipment was installed in 12 theaters in the United States, Canada and abroad. The Paramount Theatre in New York was modernized with the installation of double-frame projection and a picture 64 ft × 35 ft in size.

For theatrical projection, Paramount has developed the curvilinear aperture which enhances the feeling of depth in a picture without the need of introducing marked curvature in the screen.

From Paris we learn that the poor quality of the images projected on the screen from anamorphotic film has led the French cine industry to start a screen control in the line of definition. A special tablet has been made with an image mathematically anamorphoted with factor 2 (in other words, a design representing the alteration of the image corresponding to the one produced by anamorphotic lens). This tablet is photographed on negative film. When projected with anamorphotic lens, a print reveals defects caused by film itself, the lenses and the angle of light beam toward the screen.

Advice from the French Bureau of Standards is that architects now tend to place the projection booth horizontally in front of the screen, i.e., at the first balcony. As to sound reproduction, a control apparatus has recently been developed experimentally (LEA) with the purpose of controlling the running of film and verifying soundhead alignment.

Eastman Kodak Co. announced for the Kodascope Pageant 16mm projectors a new shutter, the Super-40, which shifts automatically between two- and three-bladed positions, providing increased screen illumination while retaining freedom from flicker during the showing of both sound and silent motion pictures.[8] When the machine is operated at 16 frames silent speed the shutter presents three blades and provides a flicker-free 48 light interruptions per second. When the projector is operated at sound speed, the additional centrifugal force produced actuates a mechanism that automatically changes the shutter to two blades, resulting in over 40% additional illumination when the machine is being used at sound speed (Fig. 13).

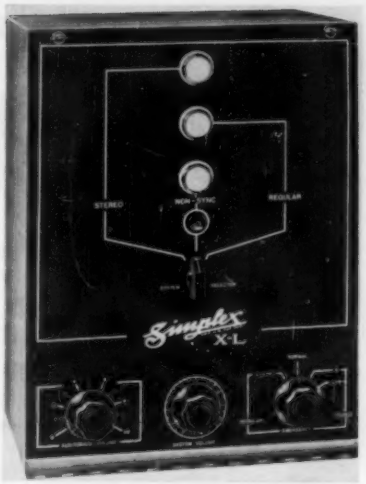

Fig. 11. Control panel of Simplex integrated sound system for theater use.

Several of the manufacturers producing 8mm projectors have gone to wider shutter openings and faster pulldowns to increase the illumination of 8mm projection.[9]

The Calvin Company announced an improved Movie-Mite projector with an automatic safety switch to cut the motor and lamp off in case of loss of

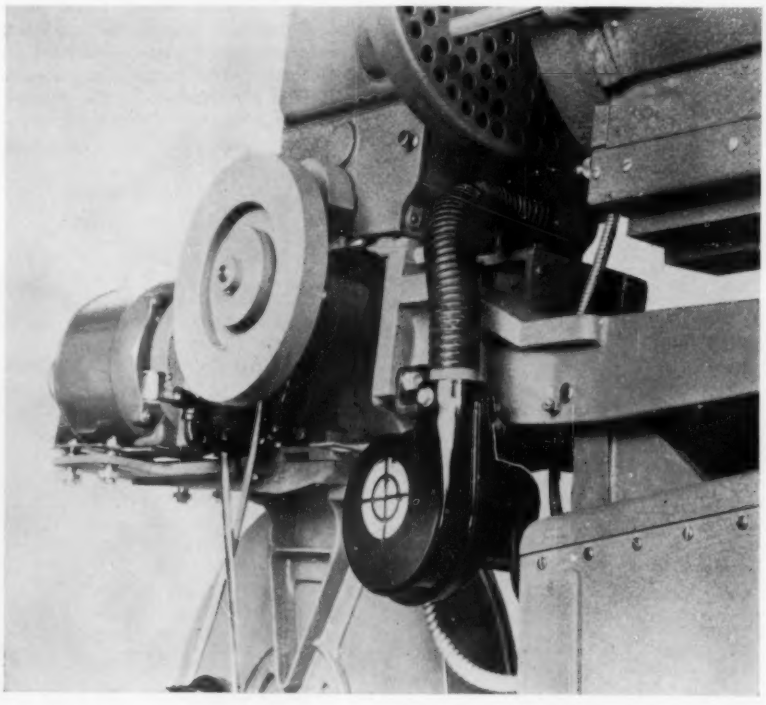

Fig. 12. An improved forced air system for cooling film on the Ballantyne projector.

Switch on at silent speed
The Super-40 Shutter automatically presents three shutter blades. With three light interruptions per shutter revolution . . . and 16 frames-per-second operating speed . . . the Pageant develops 48 light interruptions per second. Comfortable, flicker-free projection with standard illumination.

Switch to sound speed
The Super-40 Shutter shifts automatically to two blades, and screen illumination is increased by more than 40%! Yet at 24 frames-per-second sound speed, there are still 48 light interruptions per second . . . and your movies, though amazingly brilliant, are still comfortably free from flicker.

Or lock in 3-bladed position
For those occasions when you don't need the extra brilliance of a two-bladed shutter — projection in very small rooms, for example — a special latch lets you lock the shutter for standard illumination. And when you wish to return to automatic control, just release the locking lever.

Fig. 13. The new Kodascope Pageant Super-40 Shutter, designed for automatic shift, between two- and three-bladed positions.

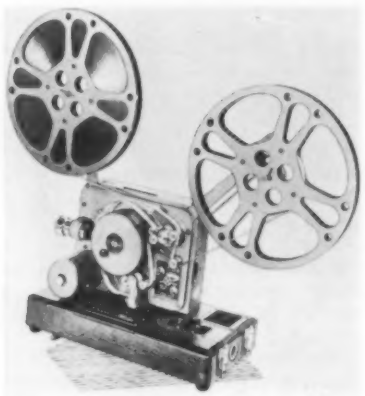

Fig. 14. Movie-Mite 16mm Projector with safety switch.

loop (Fig. 14). It requires no change of threading.[10]

Cameras

One of the new motion-picture cameras which was introduced and shown during the year was the Arricord by Arnold & Richter of Germany. It is a single-unit, double-system, picture and sound recording camera for 35mm photographic film and 17½mm magnetic film, designed for shooting picture and sound synchronously away from normal studio facilities and main power supplies. It has a 24-v d-c motor, employing a governor control which maintains the camera speed at 24 frames/sec with a tolerance of less than 1%. The camera and recording unit are mounted on a rubber suspension unit to insure maximum sound insulation and both the picture and sound mechanisms are elastically suspended in the Arriflex Blimp. The equipment comes with a mixer-amplifier and means are provided for both the recordist and cameraman to monitor the recorded sound if desired (Figs. 15 and 16).[11]

In the United States, Berndt-Bach Inc. introduced a magnetic recording attachment which could be placed on their single-system 16mm Auricon camera (Fig. 17). Known as the Auricon Filmagnetic, it permits a choice of either single-system magnetic or optical soundtrack. The attachment is used with 16mm prestriped magnetic film.

Previously, Siemens & Halske of Germany had supplied an adapter unit for the Auricon camera but it is now reported that they are using the unit being built by Auricon of Hollywood.

Eastman Kodak Co. and Walt Disney together worked out a system of photography for Disneyland which is known as Circarama. Eleven Cine Special 16mm cameras are mounted on a circular baseplate and are so arranged that they cover a 360° view in 11 sequential segments. No effort is made to have the image areas match as they are done in Cinerama but instead there is a space of several inches separating each segment of the projection screen. These 11 films are projected from a battery of 11 Eastman 16mm Model 25 sound projectors which simultaneously project color and sound movies on 11 individual screens arranged in a complete circle. Spectators standing in the middle of a specially built theater view the continuous action on an overhead screen 8 ft high and 10 ft in diameter which completely encircles the audience.[12]

A new Bell & Howell Film camera, the 70-DR, was announced. This camera incorporates a coupled viewfinder and lens turret. As the turret is rotated each corresponding viewfinder objective is automatically positioned (Fig. 18).[13] Also announced was the Kodak K-100 single lens 16mm roll film camera. This camera has a prestressed spring-power motor that exposes up to 40 ft of film at a single winding.[14]

Bell & Howell also announced an improvement in their 2709 ultra speed 35mm professional camera. This camera which is capable of operating up to 200 frames/sec is equipped with an aperture plate having a new metal surface treatment known as Bell & Howell Pebble Finish which apparently eliminates emulsion pick-up. In addition the scotch yoke and crank pin drive on the check pawls has now been changed to a ball bearing connecting rod and crank.

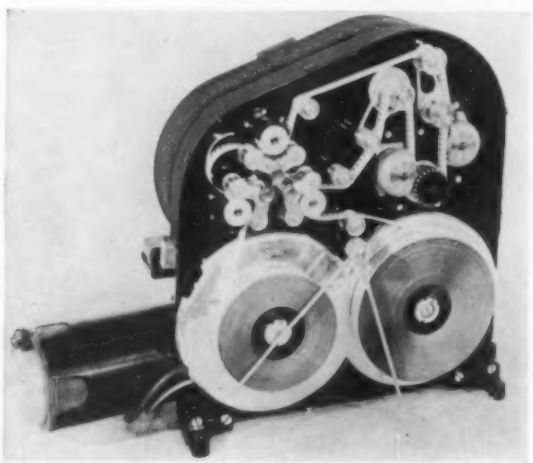

Fig. 15. Sound-recording side of Arricord Camera.

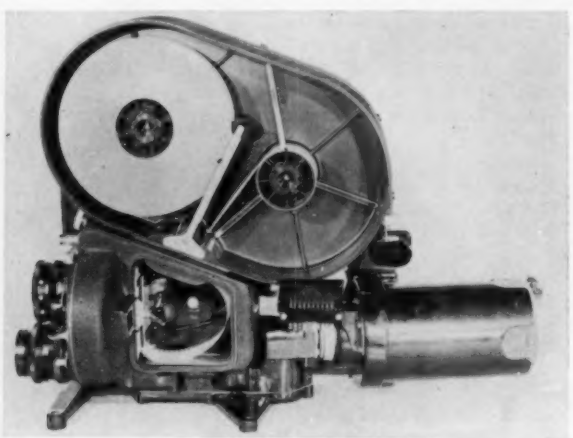

Fig. 16. Picture-taking side of Arricord Camera.

Fig. 17. Filmagnetic unit for Auricon Single-System Camera.

The Mitchell Camera Corp. has designed and produced, primarily for military use, a 70mm $2\frac{1}{4} \times 2\frac{1}{4}$ in. frame camera which can readily operate at speeds up to 90 frames/sec. The shutter is variable from 0° to 110°. The intermittent mechanism follows the general design of the previous Mitchell movements having regular picture registration pins, removable front aperture plate and roller-type rear pressure plate. The camera is driven by a 230-v, 3-phase, 60-cycle vertically mounted motor with means for phasing each camera shutter relative to some other camera or reference signal. The film take-up for the magazine is taken care of by a separate take-up motor (Figs. 19 and 20).

Production Cameras. VistaVision cameras at Paramount now number 20 units, including 12 of the new Mitchell design, 2 speed cameras, 2 Bell & Howell Special Effects cameras and 4 of the converted Stein cameras. The J. Arthur Rank Organization designed and built four VistaVision cameras (Fig. 21) of a new design which has all gears enclosed and self-lubricated. Servicing time has been materially reduced and the whole mechanism can be operated when removed from the case. The camera mechanism is isolated from the case by rubber mountings. A VistaVision beam splitting camera for traveling matte work and a high-speed camera are also in manufacture by the Rank Organization. A location camera is under construction and three more are planned. Technicolor has built several VistaVision cameras for use in the United States and abroad.

Fig. 18. New version of Bell & Howell 70mm Camera.

Fig. 19. Mitchell 70mm Camera.

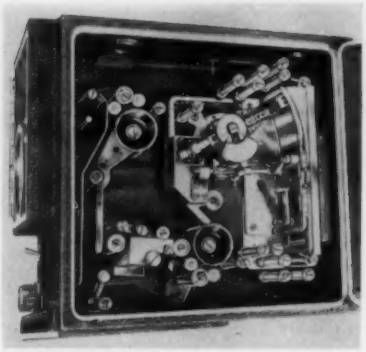

Fig. 20. Inside view of Mitchell 70mm Camera.

Lightweight VistaVision Camera. Two new lightweight VistaVision cameras have been built (Fig. 22). The new camera weighs only $18\frac{1}{2}$ lb complete with loaded 400-ft magazine, and has already been used for difficult location photography in the Alps, etc. It uses the same precise Mitchell registration movement as the studio cameras. Several types of motors are available.

A camera known as the Evaporograph[15] developed by Baird Associates of Cambridge, Mass., has the ability to form pictures from heat instead of light and is capable of seeing at night. It is said that the unit can spot a man 200 yd away and a house a mile off. It is expected that this particular device will be useful for the Armed Forces in seeing at

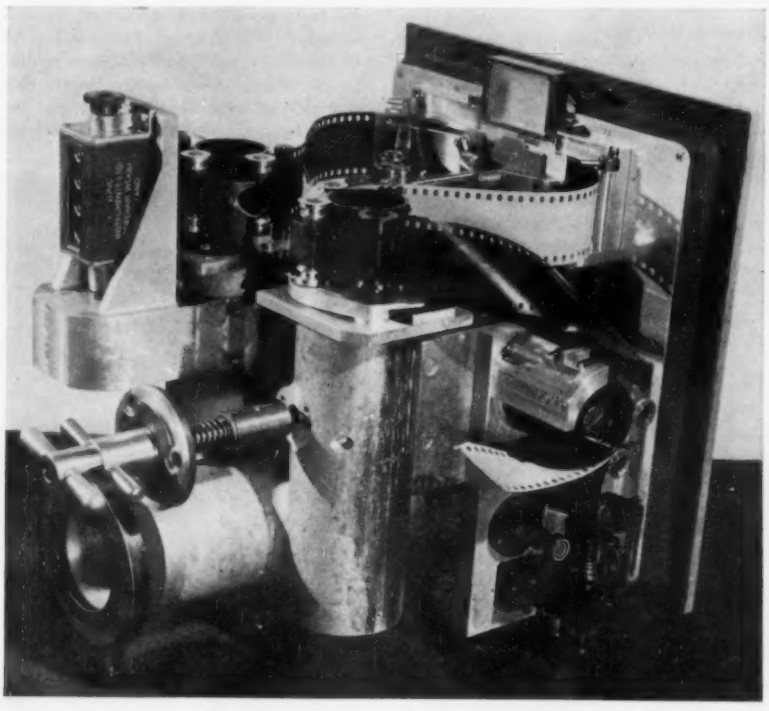

Fig. 21. VistaVision camera made by J. Arthur Rank Productions Ltd.; mechanism of camera as removed from case.

Fig. 22. One version of a VistaVision light-weight camera.

night, in construction work for finding and correcting heat leaks, in research for determining exact temperatures of various parts of a mechanism, and also in medicine.

Progress in Optics

The design of an aspheric lens to be used with elliptical mirror-type projector optical systems was described by the National Carbon Co. The purpose of this aspheric lens is to reduce the effects of the inherent foreshortening of the crater arc image formed by the outer zones of the mirror. Measurements using an $f/2.25$ mirror show an increased uniformity of both screen color and illumination at the expense of screen brightness.[16]

The Fish-Schurman Corp. announced the development of a new multilayer interference-type filter designed to transmit the visible and reflect the infrared energy of motion-picture arclamps. This filter, designated as No. 6138, has a transmission of 40% at a wavelength of 700 millimicrons as compared with the XUR-96 filter which transmits about 90% at the same wavelength.[17]

A projection lens of speed $f/1.4$, consisting of five elements, was described by Kern and Company, Ltd. This new lens is said to exhibit a significant reduction of field curvature as compared with Petzval-type objectives. In general the Petzval radius of Petzval-type lenses commonly used in projectors is about equal to the focal length of the projection lens. In this new $f/1.4$ lens this radius is said to be 2.3 times the focal length of the lens.[18]

A 2-inch CinemaScope projection lens for 16mm projection was introduced by Bausch & Lomb. The nine spherical and anamorphic components are mounted into a single barrel which can be fitted to standard 16mm projectors by means of adapters (Fig. 23).

The lens requires no brackets or supports, is $6\frac{7}{8}$ inches long and weighs $7\frac{3}{4}$ ounces.[19]

Walter Futter announced a new 16mm anamorphic attachment-type lens, Vidoscope. Designed like that company's 35mm Vidoscope lens the new lens is provided with screw mounting and attaches without brackets to 16mm professional and amateur projectors.[20]

Two new lenses were introduced for 16mm cameras. Both lenses are manufactured to Bell & Howell specifications by Pierre Angenieux of France. One lens, 10mm $f/1.8$, is said to have the widest field of view of any lens commercially available for 16mm cameras. The other, 25mm f/0.95, is one of the fastest lenses available covering a normal angle. These lenses may be mounted to any 16mm camera having a C-mount.[21] Also introduced for standard C-mount 16mm cameras were two new Pan-Cinor zoom-type lenses. The Pan-Cinor 70 has a varifocal field from 17.5mm to 70mm and the Pan-Cinor 100 has a varifocal field from 25mm to 100mm. Both lenses have an aperture of f/2.4.[22]

A 20-inch Zoomar-Reflector lens for still and motion picture cameras was shown by the Zoomar Corporation. A special lens mount is available to mount this f/5.6 lens to 16mm and 35mm motion picture cameras.[23] The Zoomar Corporation also announced the Zoomar

Fig. 23. Bausch & Lomb 16mm anamorphic projection lens.

Fig. 24. Universal TV Zoomar.

"8" during 1955. This lens, intended for 8mm cameras, has an aperture range from f/2.8 to f/16 and a zoom range from 13mm to 39mm focal length.[24]

The Perkins-Elmer Corp. has brought out a new zoom-type lens for industrial TV—the Auto Zoom, model 16 TV. It has a focal range from 30mm to 150mm (1 to 5) and a speed $f/2.7$ at 30mm focal length. From that point on the maximum speed decreases down to $f/4.7$ at 150mm. The lens is built for remote control and has three motors for zooming, focusing and iris setting. These motors are actuated from a control panel. The lens weighs $5\frac{1}{2}$ lb including motors.

Zoomar, Inc., has designed a new "Universal TV Zoomar" with a speed of $f/3.9$ and a focal range from $2\frac{1}{2}$ to 16 in. thus giving a zoom ratio of more than 1 to 6. Like all other television Zoomar lenses it allows one-hand operation because pushing and pulling the zoom rod changes the focal length while turning the zoom rod allows close-up focusing (Fig. 24).

New telephoto and wide-angle lens attachments for the Bell & Howell 220 and 252 as well as the Kodak Brownie 8mm cameras were announced by both Wollensak Optical Co. and Elgeet Optical Co.[25,26] For the Brownie camera Eastman Kodak Co. announced a telephoto and wide-angle converter. The telephoto gives a two times telephoto effect and the wide-angle converter gives the effect of a 9mm lens.[27]

An ultra-wide-angle Nikkor lens, 25mm, $f/4$, was announced for 35mm double-frame cameras. This four-element lens is mounted in a focusing mount having a focusing range from 3 ft to infinity.[28] Carl Zeiss Inc. announced the introduction of the Zeiss S-Tessar, 75mm $f/4.5$, and the 105mm Zeiss Tessar. The former is designed for a full field coverage of 40°, the latter for 55°. Both lenses are manufactured in Western Germany.[29]

A series of four offset viewfinders for use on PAR four lens turret cameras as well as on Bell & Howell and Auricon Super 1200 cameras was announced. These viewfinders permit the use of lenses of large diameter which would normally restrict the field for view of the standard camera viewfinders.[30]

A series of anamorphic camera lenses for the 55mm CinemaScope film process was developed by Bausch & Lomb. These lenses, which are of 3-, 4- and 6-in. focal lengths, are combination units

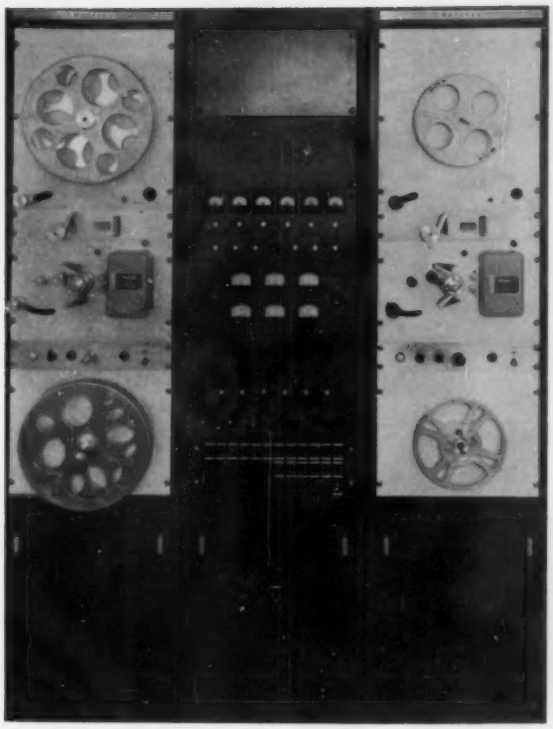

Fig. 25. Westrex RA-1552-B 70mm Magnetic Release Printer.

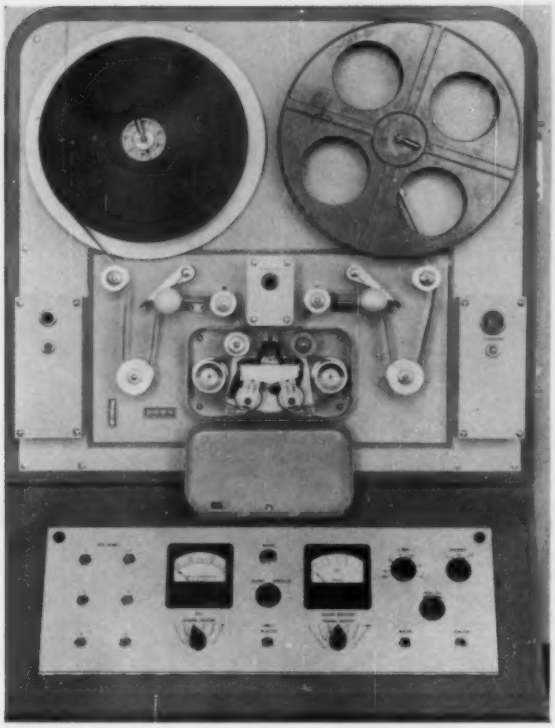

Fig. 26. Westrex RA-1547-A 6-channel portable recorder.

in which the anamorphic and objective lenses are combined in a single mount. These lenses, which differ in detail from the 35mm CinemaScope lenses, are reported to result in improved clarity, better definition and reduced distortion.[31]

Photographic and Magnetic Recording

The subject of magnetic head wear was receiving more attention due to the use of multiple magnetic track releases.[32] The Brush Development Co. and the Hamilton Watch Co. were engaged in testing new alloys which are reported to wear longer than conventional head laminations.

Progress was reported[33] in the absolute measurement of the induction on magnetic recordings by the Material Laboratory of the Navy Dept. This work was initiated at a conference between representatives of the SMPTE, Bureau of Ships and the Material Laboratory at which time the latter presented a general plan of attack. As a result of this work it is expected calibrated films will be available to the industry.

New variable-area light valves for making both standard release and push-pull direct-positive, variable-area soundtracks without the use of reflective ribbons went into service at several studios.

A Westrex RA-1552 type Release Printer was installed at Todd-AO for making 70mm release prints (Fig. 25). This is a six-channel reproducer-recorder combination with all necessary controls and test facilities.

Westrex RA-1547 Portable Multichannel recorders were introduced for stereophonic recording in major studios (Fig. 26). These are six-channel recorders complete with bias oscillator and six buffer stages and six monitor amplifiers.

A magnetic film adapter for optical film reproducers was developed by M-G-M and placed in service on 38 units. The device requires no change in the film path, needs only two mounting holes, and is designed for either 35mm or 17½mm film. A cam, operated by a knurled thumbscrew, lifts the roller and the film to clear the magnetic head when optical tracks are used. An adjustable stop on the cam permits compensation for magnetic head wear. The photograph shows the 35mm adapter (Fig. 27).

Great interest has been shown in the Telefunken microphone but the original form weighing 4 lb and having a separate power supply was limited in its usefulness in motion-picture recording. M-G-M has designed a completely new unit using only the Telefunken condenser and weighing 15 oz complete. The device, adopted by many of the major studios, has a magnetically shielded output transformer of low impedance and is completely non-microphonic (Fig. 28).

The committee also reports the widespread use of ¼-in. tape machines for re-recording loop dummies. Multiple recording channels are being used in re-recording to provide various types of storage tracks in one operation.[34]

Stereophonic Sound

The consensus from committee members is that there have been no important changes in recording or reproduction techniques for stereophonic sound release prints during 1955, exluding Todd-AO and other wide-film experiments. The real progress was probably made in the gathering of experience in striping and sound printing on the part of the personnel doing the work, with greater speed of film movement through the striping machinery and resulting labor saving.[35]

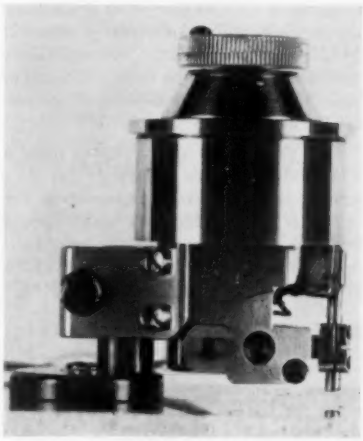

Fig. 27. M-G-M 35mm magnetic film adapter.

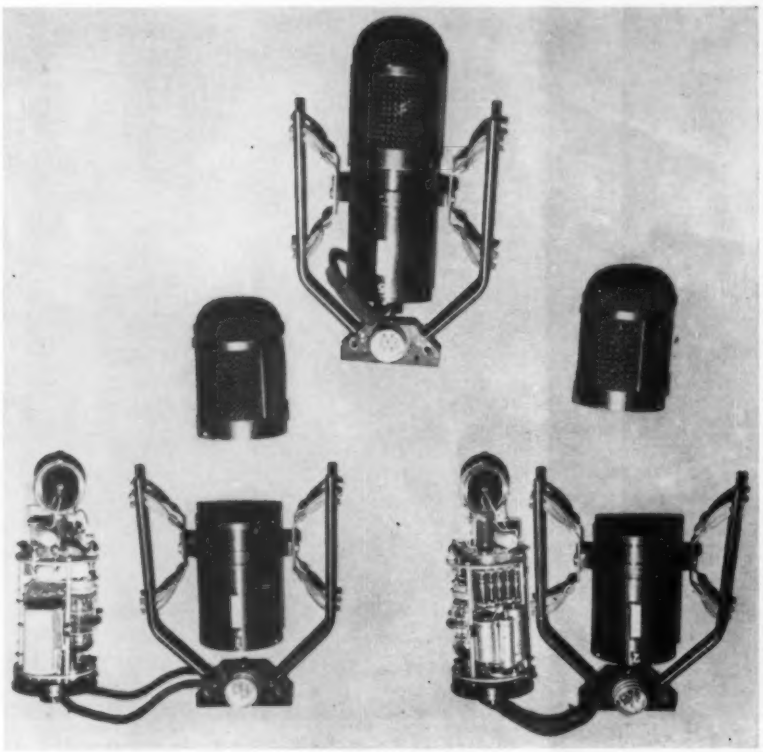

Fig. 28. M-G-M adaptation of the Telefunken Microphone.

Perspecta Sound

As of the end of the year, there was a total of approximately 2600 Perspecta installations outside the United States and approximately 200 in the United States. Advice from licensees indicates that there are about 400 orders in the hands of equipment supply dealers throughout the world for installation as soon as equipment is available. At the present time, there are 32 manufacturing licensees of Perspecta sound integrators in this country and abroad.

Licenses for the use of the Perspecta sound method of recording have been negotiated with 20 producers in addition to the five major American producers; M-G-M, Warner Bros., Universal-International, Paramount and Columbia have been using this method of recording for the past two years.

The only major development from a technical standpoint during the past year is the tentative acceptance of the inclusion of the Perspecta sound optical track in connection with the combined optical-magnetic release prints which are currently in production at M-G-M.[36]

Magnetic Sound and Striping

One-Fourth-Inch Magnetic Tape. Perforated $\frac{1}{4}$-in. magnetic tape and equipment for its use were demonstrated by the National Film Board of Canada. Considerable space savings along with improved recording properties over conventional films (magnetic films) are possible.

Extra-play tapes were produced by using thinner backings; and on 3M's No. 190 and No. 150 tapes, a high-potency oxide was applied in a substantially thinner coating and reported to compare favorably with standard tape.

Full-Coated Magnetic Films. Improvements in quality have continued. At 3M Company, special effort has been made to control uniformity transversely as well as longitudinally along the film. This control is essential for multiple-track stereophonic recordings. Several studios were using the 3M "High Output" magnetic film to obtain standard signal-to-noise ratios when recording six tracks on 35mm film with narrow track width.

Audio Devices has announced that improvements have been made to get a tolerance on magnetic film of $\pm\frac{1}{4}$ db at 60 cycles. Each reel is tested and marked.

Magnetic-Striped and Clear-Edge Film for Editorial Use. While still inferior in recording properties to full-coated materials, the versatility of these films for editing has made them widely accepted. All manufacturers have made substantial improvements in uniformity of output, cleanness of coating edge and accurate track positioning.

Magnetic-Striped Films for CinemaScope and Todd-AO. Reeves Soundcraft announced a new formulation with improved modulation noise characteristics for use on their striping machines. They also have built a striping machine for applying two 200-mil magnetic stripes to 70mm film for Todd A-O projection.

Magnetic-Striped Films for 16mm and 8mm Film. 3M Company has added to the number of laminator installations serving the industry. They have improved production techniques for the laminate providing greater ease of strippability and more certain adhesion to all types of film stock. Reeves Soundcraft has improved the edge lineation and accuracy of track placement on their liquid striping machine. They claim the sound from an optical half track has been considerably less impaired in its quality from the magnetic track. Both 3M Company and Reeves have experimented with prestriped raw stock on various films. Each claims the practicability of applying a magnetic track to unexposed film with their process.

During 1955, considerable interest was displayed in the use of magnetically striped 16mm prints for television broadcasting. This interest was especially noticeable in Canada where late in 1955 they embarked upon an experimental program for the use of magnetically striped prints with the idea of using this system in all the Canadian Television Stations. Shelley Films of Montreal installed a 3M Company Laminating Machine in order to produce prints of this type. The Armed Forces in the United States also began a substantial program using magnetically striped 16mm prints for various special purposes.

At Warner Bros. a CinemaScope magnetic-striping machine is equipped with automatic print waxing facilities to eliminate the need of a separate waxing operation on CinemaScope release prints. Other studios are installing equipment to serve the same purpose. Also at Warner Bros., CinemaScope striping machines were equipped with automatic 4-track eraser heads so that newly striped prints were automatically erased on this machine immediately after striping and drying, obviating any additional erasing prior to electronic printing. Reclaimed print stock was being used for magnetic striping, for both single magnetic and three-stripe magnetic tracks so that this striped reclaimed material could be used within the studio for its recording and re-recording operations. This striping was done during slack periods when striping machines were not busy making release prints. This operation has resulted in a considerable economy for the studio. The use of magnetic materials and recording has reached such a volume in the studios

that erasing material for future use has become somewhat of a problem and at least two studios, Walt Disney and M-G-M, have found it desirable to build automatic erasing machines (Fig. 29). The rolls of wound film are simply placed in the head of the machine and they automatically go through an erasing process, coming out the other end ready for use. This saves considerable time and also assures a uniform erasing job on every roll.

An entirely new French equipment called Picot has been made for recording on 35mm and 16mm. A new release says that this machine belongs to the type with horizontal platine and is characterized by automatic loading with the least risk of fluctuation in the running of the film, interchangeable soundheads and quick rewinding. It comprises a complete range for mixing and rerecording.

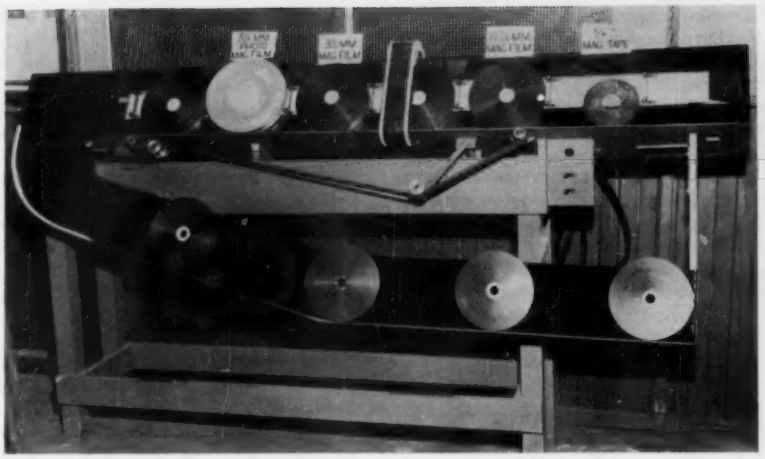

Fig. 29. M-G-M Semiautomatic erasing machine.

Black-and-White Film

One of the important developments during 1955 was the introduction by Eastman Kodak Co. of a film designed specifically for TV recording — Type 7274 for 16mm and 5374 for 35mm. It is referred to elsewhere in this report under Kinescope Recording.

The availability of a new Kodak high-speed Tri-X emulsion on 16mm reversal film was also announced during 1955. Known as Cine-Kodak Tri-X C-P Reversal Film, it is meant for processing by the purchaser or through independent 16mm processing laboratories. The daylight exposure index of the Tri-X reversal film is 200, with a tungsten index of 160, making it particularly suitable wherever adverse lighting conditions are encountered. The film provides improved tonal reproduction with ample detail in both highlights and shadow areas and is available in 100- and 200-ft spools and 400-ft rolls, either double perforated or perforated on one side. It is available on special order for high-speed camera users.[37]

New Film Base

A new synthetic safety film base manufactured by du Pont and designated "Cronar" polyester photographic film base has undergone field evaluation tests which showed that this new base is outstandingly strong and tough, characteristics which combine to give long life under projection conditions.

Cronar base is essentially clear and colorless, has good dimensional stability, and is unaffected by many common chemicals and solvents. Tape splicing methods originated as part of the research program surrounding the development of this new base have been shown to be broadly applicable and to meet some trade needs in a superior way.[38]

Color Film

1955 was the year of a big change in the processing of color film supplied by Eastman Kodak Co. Previously, many color products were sold by Eastman with processing charges included in the cost of the film and with processing done by Eastman. During the year, this policy was changed. This change also meant that anyone desiring to do so could secure a license from Eastman for processing, set up a laboratory for doing so and compete with others in securing this type of business from the user of Eastman color film. A number of companies announced that they were setting up to process 35mm Kodachrome transparencies and other Kodachrome products generally used by the amateur.[39] One laboratory installed equipment for doing 16mm and 8mm amateur Kodachrome film. Kodak would also continue to process this Kodachrome material but instead of a customer sending it direct to Kodak he had to return it to his dealer who sent it to Kodak elsewhere for processing.

At the end of 1955, it became pretty well known throughout the trade that Eastman would come out, about the middle of 1956, with a new Kodachrome duplicating film known as Type 5269 Reversal Color Print Stock. Actually, the formal announcement and demonstrations were delayed until early in January. The new 5269 Reversal Color Duplicating Film has better definition and finer grain, and uses a silver soundtrack printed from the negative track instead of a positive track as was formerly done with Kodachrome Duplicating Film 5265. The silver track made on this 5269 is thus comparable to sound from black-and-white prints. This new film 5269 is sold without processing charges included and can be returned to Kodak or sent elsewhere for processing.[40]

During the latter part of the year, a process was worked out in Hollywood for the making of 16mm color prints on color positive stock through the use of an internegative. This 16mm internegative is actually Eastman Kodak 35mm camera negative stock which has been split and perforated for 16mm. This material is then used for making a color negative from Kodachrome 16mm originals and the negative thus made is printed on the positive stock. Prints made by this method show a lack of definition and an increase in grain size.[41]

Anscochrome, a new high-speed reversal-type 16mm color film for amateur and professional use was introduced by Ansco in the Spring of 1955. The film is normally rated at E.I. 32. By special processing the speed of the film can be increased to 64 or even 128. This high speed makes color records possible of heretofore impossible subjects. The film can be processed by the user or in the laboratories of the manufacturer. Special high-speed processing service on the film is available only through the Binghamton Laboratories. Two types of film are available: daylight and tungsten; both types, processed for maximum speed are finding extensive use in high-speed cinematography missile tracking, available light color TV news coverage, and other special applications.[42] Some TV stations have been particularly interested in Anscochrome as a medium for photographing local events in color and getting fast processing.[43]

Eastman Kodak also announced what is known as an all-purpose Kodacolor film for use either outdoors or indoors to replace their standard Kodacolor line. The photofinisher adjusts his printing time for each frame according to whether the exposure was made under artificial or natural light. This film is not available in motion-picture film but could conceivably lead to some new techniques in color motion pictures.[44]

Latensification of EK-5248 color nega-

tive film increases the speed of this film so that satisfactory photography can be done at $f/1.2$ with only 30 ft-c incident key light.[45]

Blue screen matte photography is now being done on a large scale at Paramount, using rear illumination of the screen. This system permits action to take place very close to the screen without objectionable halo. The incandescent lighting frames and blue screens can be readily set up in any location. Seamless blue screens up to 90 ft in width have been used on *The Ten Commandments*.[46]

Film-Processing Equipment and Printing

A barrier-cell type of light meter for use with Eastman Color Print Film Type 5382, was developed by the Eastman Kodak Co. This meter, designed for use on release printers, is said to have very good stability and linearity of response. It has been designed to give photocell response which closely approximates the responses of the three sensitive layers of Eastman Color Print Film.[47]

A three-light, color-compensating head for use in printing color film was announced by Fish-Schurman Corp. This head, developed for the Depue reduction printer and the Bell & Howell Model D continuous printer, consists of three light sources, three condensing systems, and three sets of five neutral density filters. Each of these three systems has a colored trimmer filter. The light from these three systems is merged into a single aperture through a set of dichroic beam splitters.[48]

New designs of special effects printers for VistaVision film have been put into service. Also, improved reduction printers are now in use for both black-and-white and color.

Standard frame VistaVision color release prints have been still further enhanced in quality by the use of a series of basic improvements in Technicolor.[49] Bell & Howell reported work in progress on new printing equipment for both 35mm and 16mm black-and-white and color film. Final specifications were not given, but it was indicated that two types of printing equipment would be available — either additive or subtractive for color printing.[50]

New Light Sources

Sylvania Electric Products Inc. introduced a new light source powered by radio high-frequency energy. Known as the RF lamp, it originally was developed in cooperation with the Motion Picture Research Council to meet film printing problems. However, the new light source already has been found to have important applications in a wide variety of industrial and commercial fields, including color television, medical research, radar and air traffic control, computers and projectors.[51] The lamp has no direct electrical connections. It provides a concentrated source of light more uniform than previous sources, which means that nearly all the light produced by the lamp is usable.

In the motion-picture industry with certain types of films the speed of printing has been limited by the amount of light available rather than by the mechanical speed at which the film can be run through the printer, and it is expected that the use of this new lamp will speed up these operations considerably. The early installations were on optical printing equipment and used mainly for color separation negatives, but it is expected that the lamp will have further applications with the possibility of using the lamp for studio set lighting. The RF lamp has already resulted in an important production improvement in the manufacture of color TV picture tubes. In manufacturing color tubes, the three phosphors which are used, red, green and blue, must be fixed by a photographic process. To do this, a bright concentrated light source is required. By using the RF lamp, it was found possible to cut in half the time required for this process.

The RF lamp is heated by induction using radio frequency. The energy is concentrated into a small disc about 5/16 in. in diameter causing it to incandesce brilliantly and it can be heated to a much higher temperature than tungsten filaments. The r-f energy is carried to the RF lamp by means of a copper coil wound around the outside of the lamp from an r-f oscillator. D-c voltage source is used and the brightness of the lamp can be controlled by varying the voltage. A water line can be connected to the oscillator to cool the lamp and the coil.

Kinescope Recording

A significant contribution to the art was made by Eastman Kodak Co. through the introduction of a new film designed specifically for TV recording purposes. This film, "Eastman Television Recording Safety Film," is available in 16mm form as type 7374, and in 35mm as type 5374. It is finding wide acceptance due to greater definition and speed, improved gray scale and a spectral characteristic suitable for use with either the conventional P-11 phosphor, or the ultraviolet P-16 phosphor.

Eastman Kodak Co. also announced to the industry a plan whereby color TV recording might be accomplished through the use of embossed film, also known as lenticular film. By means of either color filter separation, or electrical and geometrical separation, light information representing red, green and blue, may be passed through small embossings, or lenticules, on the base side of a specially prepared film and recorded as adjacent, but separate, images on a black-and-white film emulsion. Conventional black-and-white film processing may be employed and by means of additive projection a composite color image can be created on a screen or on the TV system. The principle of embossed film is not new, but it has been advanced at this time because of its suitability for color TV recording, particularly for accomplishing a 3-hr time zone delay on the West Coast. The National Broadcasting Co. has announced its intention of installing equipment to record color TV programs based upon the use of the lenticular film methods as outlined by Eastman Kodak Co. Equipment built by RCA will be installed in a new NBC plant in Burbank, Calif., and is expected to be in operation by the Fall of 1956.

The Geo. W. Colburn Laboratory did some experimental work with 8mm black-and-white kinescope recording. For operation the plan is to use prestriped magnetic reversal film in a recording system similar to that of the Movie-Sound-8 magnetic-recorder projector.[52] The system operates at 15 frames/sec.

Miscellaneous Equipment

The Westrex RA-1100-F Densitometer was introduced in several studios. Besides black-and-white this measures sulfide-with-dye and silver-with-dye tracks by means of an infrared beam of essentially monochromatic radiation.[53]

A new sensitometer for practical purpose built by Kodak-Pathe, Paris, has been judged of great interest. (A special pamphlet giving its characteristics is available.)

Eastman Kodak Co. made delivery to the trade on a number of their Model 31A Color Densitometers during 1955.

An automatic laboratory scene counter was made by Consolidated Film Industries. This device shows the scene number under the screen in the laboratory projection room (Fig. 30). If a scene needs density or color correction, the viewer immediately knows the scene number without looking at a light card. He can thus concentrate on the correction needed.

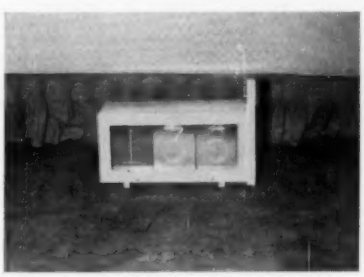

Fig. 30. Consolidated Film Industries scene indicator under screen.

Fig. 31. Arc element and control mechanism subassembly for Mole-Richardson Type 450 "Brute" super high-intensity arc spot lamp.

Several studios, including Walt Disney, reported that they are working on pushbutton devices for editing from picture negatives. Images are viewed on TV monitors, and the edited material appears on a master TV monitor.[54]

In the 16mm field, The Calvin Company announced the development of an automatic music editing and recording system. This takes library music, re-records and edits the music on magnetic film against the workprint, so the resulting tracks can be used for re-recording with the final mix. No cuts in the magnetic film are made, so it can be erased and used again.[55]

Medical

RCA announced a new TV camera designed especially for medical use. This camera, which has three vidicon pick-up tubes and three lenses, is mounted directly above the operating table. A system of dichroic filters separates the incident light into three colors, one of which is presented on each of the three pick-up tubes.[56]

"Double photography" technique, which produced combined X-ray and conventional motion-picture images on the same film at the same time, has been worked out at University of Rochester's school of medicine and dentistry. Its application is expected to result in easier methods of research in speech mechanisms involving cleft palate correction.

Production of the first commerically made X-ray motion-picture cameras has been announced by General Electric. The device takes either 16mm or 35mm film, has a $f/0.71$ lens, and a speed range of $3\frac{3}{4}$ to 30 frames/sec.

Dr. G. M. Ardran and Dr. F. H. Kemp, of the Nuffield Institute for Medical Research, announced advances in production of X-ray and optical equipment which have made it possible to take X-ray cine films at 25 to 100 pictures/sec of the movements of different parts of the body without harm resulting to the person examined. A cine camera is used to photograph the light image produced by X-rays on a fluorescent screen.

With the introduction of electronic methods for intensifying the brightness of the fluorescent image, cine films may now be taken with as little as one per cent of the dose of X-rays previously required, which enables X-ray cine examinations to be made within the limits of exposure normally used in diagnostic clinical X-ray departments.[57]

Stereoscopic Photography

The Committee on Stereoscopic Motion Pictures reported "Even the dodo is a much *livelier* animal than three-dimension except for one post-dated article in the *Journal*."[58]

Improvements in Studio-Lighting Equipment

Set lighting levels continued to rise during the year 1955, reaching values as high as 1800 ft-c on some of the larger color sets in the ever-present struggle to obtain good depth of focus with the newer camera techniques. The increase in lighting demanded more use of powerful lighting units: the 225-amp Type 450 Brute Molarc[59] and the 10-kw incandescent spot lamp.[60] By the end of the year there were 363 Brute arcs in service, 95 of which were added in 1955. During the year, 717 10-kw incandescent lamps were added to bring the total to approximately 3300.

The 16mm × 22 in. Super High-Intensity yellow-flame positive carbon[61] developed for the Brute arc lamp has almost entirely replaced its white-flame predecessor except on daylight locations where film is exposed on a white light basis. To date the yellow-flame carbon is used with a lamp filter which consists of the standard Y-1 gelatine sprayed on one side with a special lacquer having transmission characteristics similar to the 2-B camera filter. Development work is nearing completion for a new filter which will eliminate the necessity of the lacquer spray.

Development of the yellow-flame carbons for the Type 170 Molarc is in process at the National Carbon Co. Efforts are pointed toward color-corrected carbons which will give satisfactory performance without necessitating change in the standard Type 170 equipment, as was accomplished in the case of the yellow-flame carbons for the Brute lamp.

The tail flame produced by the yellow-flame arc in the Brute lamp produces an apparent variation in the foreground illumination on the set which is more noticeable to the eye than that produced by the white-flame arc. In most cases the effect is photographically negligible, but is effectively eliminated by a shield (Fig. 31) developed by the Mole-Richardson Co. for installation on

Fig. 32. Two-unit remote switchboard, Mole-Richardson Type 295.

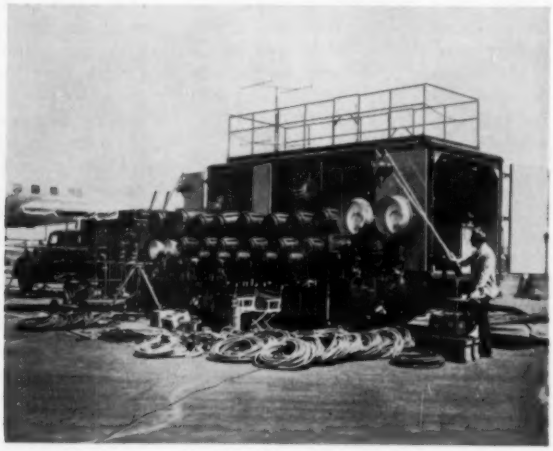

Fig. 33. Mobile photographic equipment unit, Douglas Aircraft Co., Inc., Santa Monica. Calif.

the arc element within the lamp housing. The shield is available in kit form and may be added to standard lamp equipment.

A new positive brush assembly (Fig. 31) was developed by the Mole-Richardson Co. for the Type 450 Brute Molarc in which the previously used cast nickel brushes were replaced by wrought nickel parts protected from the direct radiation of the arc by Inconel baffles. The new design results in a much longer brush life and a considerable decrease in parts replacement costs. The new brush assembly is available in kit form for installation in Brute lamps.

With the increase in the quantity of the larger lighting units on sets, a need arose for power-driven elevating stands. Some stands are hydraulic, some use bottled compressed gas for the source of lifting power and others are of the electric motor driven, telescoping jackscrew type. One of the newer electric stands developed will accommodate lamps up to the 225-lb Brute size, has "up" and "down" pushbutton operation for positioning the lamp at any height from $7\frac{1}{2}$ to $13\frac{1}{2}$ ft above the floor, operates on either a-c or d-c electric supply and can be folded for transportation.

The increase in the number of 10-kw incandescent lamps rigged on the parallels was accompanied by an increased demand for portable remote switchboard units for turning the lamps on and off. Most of the remote boards contain two double-pole contactors and can control 800 amp of lighting load through four circuits each fused at 200 amp. On a large set in one of the major studios 70 such remote boards were rigged to control a total possible capacity of 56,000 amp of incandescent lighting load. A typical remote board developed during the year is shown in Fig. 32.

The steadily increasing activity of documentary film production in industry was markedly reflected by the year's expansion of the lighting facilities employed. Since many of their productions are on location rather than in a studio, mobile units capable of transporting all of the necessary equipment are not only desirable but practically a necessity. For example, Douglas Aircraft Co. built a completely mobile unit (Fig. 33).[62]

Fig. 34. Breakaway beams cast from phenolic foam resin.

A television studio lighting conference was held in April 1955, at the General Electric Co. Lamp Division Lighting Institute at Nela Park, Cleveland, Ohio. The conference was attended by representatives associated with lighting at the various TV stations throughout the country.

Increased quantities of Babys, Juniors, Seniors and the 10-kw incandescent spot lamps have been used on television sets. The "light-modeling" possibilities of these Fresnel lens type lamps have aided the lighting directors in attaining the desired dramatic effects.

The General Electric Co. and Bausch & Lomb announced a series of tests made to reduce temperatures on motion-picture and television sets. This was done with interference film heat control coatings on the lenses and mirrors of a 750-w and 5-kw spot light. The system was demonstrated at the Society's Convention at Lake Placid.[63]

Studio Constructon Materials

No major contributions concerning types or application methods of set construction materials were noted during 1955.[64a]

Early major developments were indicated in the field of foamed-in-place or expanded polymers, particularly polyurethanes. These versatile materials can be fabricated by relatively simple and inexpensive methods into rigid or flexible props and structures of light weight with variable degree of tensile strength. Expanded polystyrene beads and phenolic resins were investigated in search of materials which could be fabricated into light-weight rigid breakaway props. A phenolic foam resin[64b] of this type was successfully introduced and employed in the fabrication of rocks, ceiling beams and various props (Fig. 34).

Newly available additives which promote thixotropic properties in liquid compounds have found increasing use and have aided in the solution of various production problems and assignments. Some are used to obtain polyester resin gels and paints which are sag-free. Others were employed in formulating water soluble compounds which simulate the flow properties and appearance of greases and crude petroleum.[65]

Plastic snow flakes were described in a Research Bulletin.[66]

A method of mirror-coating props and structural units fabricated from wood, plaster, plastics or any other suitable material was developed to allow the simulation of gold, copper, brass, silver, and other metallic surfacing effects with a remarkable degree of fidelity. This process was particularly investigated, improved and employed for production by 20th Century-Fox and Paramount.[67]

A lacquer-type compound developed by Minnesota Mining and Mfg. Company has the same basic function and properties as Scotchlite sheet material and was introduced and used in production by several studios. The sprayed or brushed-on coating, when dried, will reflect incident light back to the light source with great efficiency. Many interesting applications are expected of this product.

Fig. 35. The GPL Television Projection System, Model PB-611B.

Studio Equipment

Double-Frame Triple-Head Background Projection. The Paramount background projector equipment has been completely redesigned and rebuilt for double-frame print projection. This improvement was necessary so that projected backgrounds would match in quality the double-frame camera foregrounds. The modifications included a new double-frame horizontal aperture, registering pulldown movement designed by Mitchell; the new yellow-flame carbons; special baffles to reduce the heat at the film aperture area; a new high-efficiency condenser system; new $f/2$ projection lenses of 10-in. and 12-in. focal lengths; remote pan and tilt of the mirrors and remote focusing. Sufficient light is now available for rephotographing projected background scenes 28 ft in width with the camera at $f/4$, and using conventional transparency screens.

High-Efficiency Background Projection Screen. Paramount has developed a new transparency screen which is approximately twice as bright as conventional screens. In the future it will permit color transparency shots to be made on a 40-ft wide screen with the camera operating at $f/4$.

TV Remote Pickup

The general feeling reported from the industry was that 1955 did not reveal any significant new equipment in the remote field; however, emphasis was placed on the operational aspects of remote television broadcasting. Such shows as NBC's *Wide, Wide World*, CBS's *Person to Person* and ABC's *Dateline Disneyland* put the complexity and overall operating of equipment by individual networks on a grander scale than had ever been done in the past.[68]

Large-Screen and Industrial TV

RCA reported that engineering development is being carried forward in improving color theater TV; however, no installations of this type of equipment for commercial theater use were reported for 1955. Large-screen, closed-circuit TV was used in a number of cases for business communication.[69a] There were no other reports of work on large-screen theater TV.

The FL-1001 TV Projector of Fleetwood Corp. was briefly described as equipment designed for smaller theaters and for hotel installations for business conferences.[69b] Equipment by General Precision Laboratory and Raytheon Mfg. Co. was used to study traffic[69c] and the General Precision Laboratory closed-circuit TV projection system, Model PB-611B (Fig. 35), was used not only by Theater Network Television, Inc., for telesessions of the Marciano-Moore boxing match but also for such as for an overflow session at the opening of the Hospital for Special Surgery in New York.[69d]

RCA put into operation a new color TV camera designed especially for medical use, demonstrating it first from the Veterans Administration Hospital at Philadelphia. An operation was picked up, transmitted to a mobile color TV unit outside, then relayed to be seen on a 15×20 ft screen.[69e]

Closed-circuit industrial and institutional TV was a considerable activity during the year that was not generally reported to the Society. Culmination of very recent activities is reflected in forthcoming papers which should be summarized next year. To meet sustained demand, General Precision Laboratory revised its Model PD-150-1 (Fig. 36), providing an intercom system between camera and control location, a voltage regulating transformer to accommodate wide fluctuation, and protection against horizontal and vertical sweep failure.

Fig. 36. The GPL Precision Television System, Model PD-150-1; shown are fixed focus camera and camera control unit.

Television Networks—Improvements and Expansions

Television Network Growth. During 1955 about 3,000 channel miles of TV facilities were added to the networks, bringing the total to about 72,000 miles. About 31 TV stations in 31 cities were joined to the network last year, extending network service to 391 TV stations in 262 cities in the United States. At the same time some 4,000 channel miles of the network were equipped for color transmission, bringing the total to about 51,000. Color transmission was extended to 51 stations and 33 cities, linking some 190 stations in 135 cities to the color network (Fig. 37).

A coaxial cable equipped with a broad-band L-3 carrier system between San Francisco and Los Angeles was brought near completion during the year. With this latest type system a pair of coaxial tubes can accommodate 1800 separate telephone conversations or 600 conversations and a 4.2-mc broadcast television channel in each direction. Initially the system will be equipped for 600 telephone and four television channels. It is expected to be in operation by August in time for the Republican National Convention in San Francisco. The new cable will supplement existing TD-2 microwave radio facilities already in service on the route.

Television Operating Centers. The new low-impedance video switching and associated control equipment has been ordered and is being installed at Chicago, Los Angeles and New York for service early this summer. This switching system will improve video transmission through television operating centers and will feature preselection of switches, individual or salvo operation, centralized testing positions and application to remote controlled switches. Smaller versions of the 30-input-by-30-output switch are being made available for other locations where load requirements are less.

Microwave Automatic Switch Installations. A new automatic switching system for TD-2 systems has been developed and during 1955 has been put into service on practically all major routes of the network. This system automatically replaces any one impaired channel of five working channels by a protection channel in a very short time (1 msec for fading and about 40 msec for sudden equipment failures). Fading restoration is practicable as the six channels are on different frequencies and as fading is primarily frequency selective in these systems. The switching system goes into action before unserviceable transmission conditions obtain and this, together with the extremely fast action, serves to reduce fading service reaction to as little as 0.5 msec. The complexity and high cost of the switching system have limited its application to main routes where the effects of fading and equipment outages are cumulative.

Although the switching system is in operation as outlined, the intial experience has indicated the possibility of improvement and the need for resolving fringe design problems which presently are under active study by the Bell Laboratories.

Off-the-Air Pickup Service. Off-the-air television service is being furnished to three customers and several more are scheduled for service in the immediate future. This system provides an economical service to outlying communities where the limited audience makes such economies a prime requisite. This service derives the video and audio signals about 60 to 70 miles from a designated broadcaster and, by economical radio-relay facilities, delivers these signals to the re-

Fig. 37. Chart showing Bell system TV network routes.

ceiving customer's broadcast station location. Economies are effected not only by the long initial jump but by savings in buildings, towers, power-supply arrangements and related factors in the radio-relay system made possible by the so-called light-route construction.[70]

Bell Telephone Laboratories announced they are working on a new long distance microwavepipe carrying many television programs. According to information released, tens of thousands of cross-country telephone calls along with hundreds of television programs may someday be carried in a single 2-in. metal tube. The long-distance waveguide developed by Bell could be buried underground and would funnel extremely short microwaves up hill, down dale and around corners. It is constructed of thin copper wire, tightly coiled like a spring under pressure and wrapped inside a flexible outer coating which holds the wire in place. In laboratory tests, microwaves have been carried for 40 miles in a metal tube with the same loss of strength encountered when the waves travel 12 miles in a coaxial cable. The system uses microwaves shorter than any previously used in communications.[71]

Color TV

Color television as a technological development is undeniably a success. It works. Most of the major troubles it was born with have by now been engineered out. According to a reporter who went with cynical predisposition to watch a color broadcast, followed by a black-and-white rebroadcast for comparison, the latter seemed flat and dull. "You almost wanted to turn away," he said later.

This makes it doubly sad and puzzling to the industry that, so far, color TV as a commercial venture has not worked at all. The Federal Communications Commission approved the industry's color broadcasting standards in December of 1953, thereby telling TV networks and set makers to go ahead and sell. It is now more than a year and a half later, and color sets still gather dust on shelves.

Now, the industry is ready to make another try. Predictions are that color TV will finally start to sell either late this year or some time in 1956.[72]

During 1955 the interest in color TV broadcasting seemed to increase, and there are now over 190 TV broadcasting stations in this country ready to transmit network color, and some 20 are equipped to provide live color performances. Also, some 65 stations are prepared to broadcast color film. Many TV stations are installing improved studio lighting equipment, so that color programs may be produced locally when required.

It may be said that network color TV program broadcasting increased by about 400% over that in 1954; color TV receivers have been simplified to some extent, a most desirable necessity; and the list prices of color TV receivers have been slightly reduced, as compared with 1954. There still remains the great need for further simplification of circuits, as well as reduction in the list price of receivers being offered.

In the field of AM and FM broadcasting, as well as in some TV stations, there has been an increased use of tape and film facilities, so as to make regular operation more efficient.

In TV broadcasting a new medium of color TV studio program pickup known as the Vitascan[73] has been developed. It greatly simplifies some types of studio color pickup. Another device, the Electronicam has been developed, in which a special motion-picture camera and a TV camera have been combined, so as to make a TV picture and a motion picture simultaneously.[84]

There have been few developments of note in new black-and-white TV transmitter or studio camera design.

A continuous projector designed especially for color TV is the Eastman 16mm continuous projector Model 300. It accommodates a 3-in. $f/1.6$ lens covering $2\frac{1}{2}$ frames. A gate curvature of radius approximately equal to the focal

length of the lens is used to minimize keystoning.[74]

The RCA Model TP35CC intermittent motion-picture projector for use with the three-vidicon film camera for color TV was announced. A 1000-w incandescent lamp is used as the source, refracting condensers are included in the optical system along with an $f/1.9$ projection lens. The unique accommodation of 24 frames/sec film rate to the 30 frames/sec TV system makes this projector adaptable for all storage and semi-storage film pickup systems.[75]

General Precision Laboratory reported development and design work during 1955 on the Model PA-200 GPL 35mm Telecast Projector, using the Simplex XL projector mechanism and soundhead. It is to be fully described at the Society's 1956 Spring Convention. It is designed for use with the three-vidicon color or monochrome film chains, and also it is suitable for still-frame operation.

The use of a continuously variable neutral-density filter wedge in the condensing system of TV projectors was described by RCA. This filter, which is remotely controlled by a servomechanism, compensates for varying film density. Thus the signal-to-noise ratio of the system is maintained at its optimum value inasmuch as the camera is operating with essentially constant input level.[76]

RCA worked to push up color tube production.[77] Crosby Enterprises (Ampex) and RCA were still working on the problem of taping color TV.[78]

Aiming toward a color TV camera no more complex than present monochrome devices, RCA engineers have developed a tricolor vidicon that generates red, green and blue signals simultaneously.[79] It has been used successfully to televise color slides and motion pictures where high light levels are employed. Further refinements are expected to achieve greater sensitivity.

The following was reported regarding color TV progress in England: Throughout 1955, considerable effort was devoted to the basic problems, although no decision is likely to be made for some time on the introduction of color TV or on the standards to be used. Early in the year, closed-circuit demonstrations were given of both static and moving color pictures. The encoding and decoding methods were those of the NTSC system, scaled to British standards. The displays used were 15-in. RCA tricolor kinescopes and a 3-tube direct view monitor using 17-in. rectangular tubes, the latter providing extraordinarily good resolution and contrast. Close liaison was maintained with British receiver manufacturers on problems relating to color receiver design, and some development work was initiated on r-f and i-f sections of color receiver circuits. This resulted in the production of circuits with a frequency response which is flat to within −0.5 db up to 3 mc/sec from the vision carrier frequency (the maximum video frequency) and an attenuation of 40 db at 0.5 mc/sec greater than this (the position of the accompanying sound carrier frequency).

A 16mm slide and motion film flying-spot scanner was built for color work, and a Marconi 3-tube color camera and associated equipment acquired. These equipments have been installed for test and demonstration purposes in one of the original London studios. Several series of test color transmissions using slides and film with accompanying sound have now been radiated from the London station in order to assess the problems arising from the reception and reproduction of such color signals on existing monochrome receivers. So far, the results appear to have been encouraging and further tests are planned.[80]

Pay TV

One of the significant developments in 1955 was the submission of briefs to the Federal Communications Commission by the leading companies in the pay TV field, with each of the briefs containing a more or less complete technical disclosure of a proposed pay TV system.

Skiatron Electronics and Television Corp. proposed a combination of methods of encoding the video information, involving shifting the phase relationship between the video signals and the horizontal synchronizing pulses on a field-to-field basis, and polarity inversion of the video.

Zenith proposed a system which employed shifting the phase of lines of the video signal relative to the synchronizing pulses and inverting the phase of the audio.

International Telemeter Corp. proposed a system in which two channels of video were provided by utilizing the frequency interleaving principle which is exploited in the present NTSC Color System. The unpaid receiver receives one video display called the "Marquee" and the paid receiver receives the Program. The Telemeter System also employs a dual audio channel which is achieved by frequency multiplexing. One channel is used for information about the program and the other for the program. Security is achieved in the video system by shifting the phase of the reference frequency (corresponding to the color burst) and in the audio portion by transferring the two kinds of audio interchangeably from one of the available channels to the other.

Dissenting briefs of a political rather than technical nature were filed by the networks. Jerrold Electronics Corp. filed a brief proposing a wired TV system as an alternative pay television system.[81]

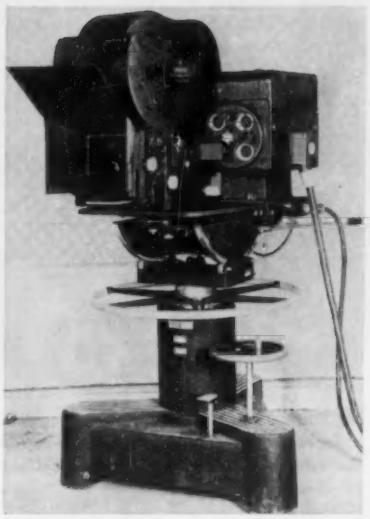

Fig. 38. Front view of Du Mont 35mm Electronicam.

Electronic Photography

During 1955, three organizations announced plans to use TV cameras in conjunction with photographic cameras of conventional design, to get the advantages of the two media for greater production flexibility and economy. The approach employed in prototype models of both the CameraVision system[82] and the McCadden Production system[83] was to utilize a vidicon camera having its own lens system as an electronic viewfinder for the film camera. When used in a multiple-camera arrangement, the operation of all cameras can be observed on monitors in a central control booth. Switching of the electronic pictures can be accomplished for purposes of viewing a "rough cut" on a television monitor and/or making a kinescope recording of the composite feed to serve as a guide in later editing of the film camera negatives. Mechanical and electrical means were employed to eliminate or minimize the effect of parallax resulting from separate lens systems for the vidicon and film cameras.

The Electronicam system developed by Du Mont,[84] on the other hand, employs the same lens system for both television and film cameras, then splits the light — either by an optical cube or on a time sharing plan using a rotating front-surfaced mirror — so that a portion of the light goes to each camera. A standard image-orthicon camera of broadcast quality is used with only slight modification, thereby permitting simultaneous broadcasting of the TV picture while direct film recording is taking place in the studio and a kinescope recording is being made for use later as an editing master print. The Electronicam system has been successfully used on many network TV programs, and promises to be an important factor in TV film production in the immediate future (Fig. 38).

Fig. 39. The underwater television camera of Pye Ltd., Cambridge, at the industrial television show on the Lake of Zürich, May 1955.

Fig. 40. Pye television equipment mounted on 12-in. refractor at the Dunsink Observatory for demonstration at the Astronomical Congress, 1955, held in Dublin.

The much awaited video tape was still in the development stage in 1955 and had not as yet been employed in day-to-day commercial broadcasting. Various engineering approaches are being made and workers in the field express confidence that commercially successful results will be achieved.[85]

TV Developments in Europe

Compensation of Video Distortion. Video signals are often distorted. The distortion introduced is in most cases of a linear nature. Several attempts have been made to reduce or compensate this distortion.[86,87,88]

Distributing Amplifier. An interesting distributing amplifier has been developed by the laboratory of the Swiss PTT.[89] It serves to feed several video signal lines with the right impedance match from one signal source. It can be used for all television standards, which are working at present in Europe.

Industrial TV. Pye of England has specialized on industrial TV[90] and has given a big exhibition and demonstration of the many possibilities including underwater TV in the Lake at Zurich, Switzerland (Fig. 39). At the International Astronomical Congress, 1955, held in Dublin, a Pye TV camera was mounted on the 12-in. refractor at the Dunsink Observatory (Fig. 40). The astronomical picture can, by the aid of television, be photographed and observed by an unlimited number of persons.

The TV Tower of Stuttgart. A 690-ft TV tower has been erected in Stuttgart, Germany. It consists of reinforced concrete and has at a height of 470 ft rooms for two 10/100 kw television transmitters, a kitchen and a two floor restaurant. The diameter of the tower is at the ground 36 ft and at the top 17 ft. Having the television transmitter at the upper end of the tower, eliminating a long feeder cable, improves the efficiency by about 20%.

A Small Television Transmitter. Rohde & Schwarz have built a small television transmitter[91] for exhibitions, advertising and demonstrations. The transmitter, which is equipped with all apparatus for normal television transmission, has an output power of 20 mw and can feed 200 normal television receivers.

Scatter Propagation. In Germany, investigations of scatter propagation have shown[92,93] that under certain conditions good vhf connections over larger distances than direct sight are possible. At 533 mc/sec over distances of 125 miles, 60 miles out of direct sight could be worked with success.[94]

Color Television in Europe. European nations are very interested in color TV[95] although many years will pass until it is officially introduced. The matter will be discussed at the next plenary meeting of the CCIR in Warsaw in the summer of 1956. The American NTSC System is studied with interest. Marconi has delivered a color TV installation (Fig. 41) for experimental color transmissions[96] of the BBC. Also, in Russia an experimental color TV transmitter is in operation.[97] working with the frame-sequential system.

European Television Standards. The different black-and-white TV standards bring several difficulties. One difficulty is the conversion of TV standards at the international program exchange. Fairhurst reported[98] on an interesting possibility of standard conversion. Another difficulty exists in zones where two or more transmissions with different standards can be received.[99]

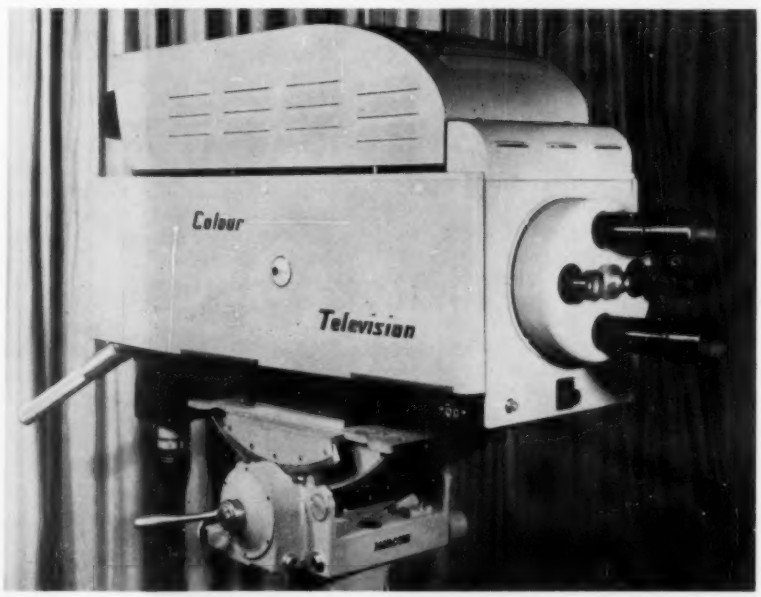

Fig. 41. The color television camera of Marconi, England, for the experimental color-television transmission of the British Broadcasting Corp.

Photo-Electron Stabilized Iconoscope. A photo-electron stabilized iconoscope has been developed by the Fernseh GmbH.[100] This does not have the disadvantages of the supericonoscope.

Television Developments of the BBC During 1955

During 1955, the population in the United Kingdom to whom the BBC Television Service was available was increased from 91% to 93.5%. This was achieved by opening new transmitters in East Anglia and in the Channel Islands, and by replacing temporary equipment with permanent installations in Northern Ireland, northeast England and northeast Scotland. During this period, the number of TV licenses increased from a little more than 4 million to nearly 5½ million, and the average nightly audience was estimated to have grown from 11 million to nearly 14½ million people.

The new London transmitting station at Crystal Palace is nearing completion except for the 640-ft support tower for the aerial. This is now some 400-ft high but the ultimate design of the upper section depends upon whether the Band III aerial system for the Independent Television Authority's London transmissions will also be accommodated on the structure.

The vision and sound transmitters at Crystal Palace each consist of two identical and complete transmitter units which normally will be operated in parallel; the outputs of each half of the vision transmitter, after vestigial sideband shaping, are separately combined with the outputs of the two halves of the sound transmitter. Two separate feeder systems will carry these two combined signal outputs to separate halves of a high-gain aerial system. Comprehensive switching facilities will enable either half of each transmitter to be combined with either half of the other and for the combined output thus obtained to be connected to either half of the aerial system. Thus the service may be continued at reduced power should either half of the sound and/or either half of the vision transmitter fail and/or a fault develop on either half of the feeder/aerial system. A common crystal drive will be used for the two vision transmitter sections and similarly for the two sound transmitter sections, and phasing units will ensure a correctly additive condition for the radiations from the two halves of the aerial system. The final full effective radiated power will be about 200 kw and the station will serve some 13 million people in southeast England. However, this condition is not expected to be realized until 1957 after completion of the top section of the support tower which will carry the permanent aerial. The station will replace the present London station in the Spring of 1956 using a temporary aerial system mounted at a lower level.

Work is now reaching an advanced stage in the conversion for television of two additional studios in London, formerly film studios, with areas of 4,500 and 5,500 sq ft, and these should be in operational use by mid-1956. These additions will permit withdrawal one at a time of three of the existing studios for re-equipping with new lighting and Emitron camera equipment. A second theater is also being prepared for temporary use for TV audience shows, and it is hoped to bring this into use by the summer of 1956, thus releasing the present Television Theatre for extensive modifications to the lighting system and the installation of new camera equipment.

Developments in studio equipment and techniques include the adoption of 4½-in. image orthicon tubes for operational use in one studio. This equipment is now providing pictures of improved quality compared with those from the 3-in. tubes previously used. In addition, the new cameras in this studio incorporate thermostatically controlled heating and do not require the use of blower motors for cooling, thereby eliminating noise which, at times, was picked up from the earlier cameras by the studio microphones. It is also proposed to provide small picture monitors on microphone boom carriages to assist the boom operators in positioning their microphones.

Plans for early extension of facilities for interviews include the provision of a small studio near Broadcasting House where a temporary one is already in use, and another at London Airport to be shared with the BBC sound service and with newsreel companies. Studios at four centers outside London recently brought into use are now available for television production using mobile outside broadcast units. Three individual camera channels have also been installed at strategic points outside London for simple contributions to the network.

The Scenery Block and the Restaurant for the BBC Television Centre at the White City, London, have now been completed, although the latter is being temporarily used for office accommodation and for rehearsal rooms. Work has also started on the excavations over an area of 3½ acres preparatory to the laying of the foundations for the main block of the Television Centre.

Continuity operation has now been adopted for the TV network, i.e., all programs normally pass through the London control center before distribution throughout the network. Although this means that programs originating, say in Scotland, have to travel some 500 miles to London and 500 miles back again before radiation from the Scottish transmitters, tests have shown that no significant degradation of picture quality results.

The problem of deriving the correct aspect ratio from CinemaScope film for TV transmission has been solved in the following way. The film is scanned in a flying-spot Mechau system in which the line-scanning amplitude is reduced to the same degree as the film picture is horizontally compressed, thus extending the central portion of the film picture by the correct amount. This method avoids the use of special anamorphic or cylindrical lenses, but means, of course, that a strip along each side of the film is lost. The flying-spot Mechau system is used because of the difficulty of changing the scanning aspect ratio in other telecine equipments.

Four new Mobile Control Rooms of similar design, manufactured by Marconi's Wireless Telegraph Co. of Chelmsford, have been brought into service for outside broadcast work. The vehicles themselves are only 34-ft long and the bodies, of double-skinned construction, are fitted with plant which controls both temperature and relative humidity. Each M.C.R. is equipped to operate with three image-orthicon cameras and contains all the associated waveform generation, control and vision mixing equipment. The cameras are designed for the 4½-in. image orthicons, but are being operated for the time being with 3-in. tubes. The turrets fitted to these cameras allow lenses of 2-in. and 40-in. focal length to be mounted simultaneously as well as two further lenses of intermediate focal length. A variable-density neutral filter operated in conjunction with iris control from the control vehicle allows scenes of widely differing luminance to be televised while simultaneously permitting control of the depth of field over a greater range of distances than was previously possible. Sound mixing facilities exist for up to ten microphone circuits; a high-grade monitoring loudspeaker is included and comprehensive talk-back facilities are provided.

Although M.C.R.s are normally operated from the public power supply, two new mobile power supply vehicles allow broadcasts to be made from points where no public supply is available. Each of these units can supply the power necessary for the complete M.C.R. equipment and has a maximum output of 18 kva obtained from a diesel-electric set which is fitted with an Isospeedic governor for close automatic speed control, and can run on full load without refueling for 7½ hr.

The success of the single image-orthicon camera "Roving Eye" unit carrying its own power generating and Band III vision and Band II sound and communications link equipment has led to the request for further facilities of this kind. Consequently, design work has proceeded on a second type of unit which, by only a slight increase in vehicle size, will permit two camera channels to be carried and operated while on the move.

The distances from the main television distribution network from which BBC Outside Broadcasts can be made has been greatly extended by increasing the number of microwave link equipments and by the introduction of mobile extending aerial tower vehicles; five of these are already in use. Microwave transmitting or receiving paraboloids and their associated electronic equipment can be raised by the telescopic extending towers and oriented by remote control with an accuracy of $\frac{1}{2}°$. The towers are erected, from the almost horizontal position in which they are carried on the vehicles, by a system of hydraulic rams, and a similar system then extends the mast to any desired height up to a maximum of 60 ft. The towers are self-supporting, but provision is made for staying them in high winds. The maximum range achieved with transmissions from these towers, using 3 w at frequencies of approximately 4,500 mc/sec over optical paths is about 45 miles.

A new zoom lens recently brought into use is of considerably reduced weight compared with earlier models of similar performance. It has two focal length ranges, 4 to 20 in. and 8 to 40 in., either of which may be selected before fitting to a camera in place of the normal lens turret; this operation can be completed in a few minutes.

An air-to-ground TV program was successfully presented on August 27. The equipment in the aircraft consisted of two cameras, one with views forward and downwards to the ground, and the other giving views of the cockpit and forward through the pilot's window. Power conversion equipment was designed and constructed for operation of the TV equipment from the aircraft 24-v supply. The frame frequency generated by the airborne equipment was locked to that of the national grid mains supply system by using a ground-to-air radio link carrying mains frequency modulation. A Band III vision transmitter was used with an output power of about 10 w peak, and a radio check monitor was provided for reception from the local Band I TV station. A lip microphone was used for the commentary, and the output from a separate effects microphone and from the aircraft intercommunication system could be mixed as desired and used to modulate a Band II FM transmitter with an output power of 18 w. Satisfactory pictures were obtained during take-off and landing and also up to a range of about 15 miles at 2,000 ft.

During the year, installation was completed by the Post Office of a permanent two-way coaxial cable vision link between London and Dover. This was brought into operation in September for European Television Program Exchanges. Pending the installation of a permanent cross-Channel radio link, the Dover end of this cable has been extended to the temporary equipment near Dover which is operated jointly by Radiodiffusion-Television Française and the BBC. The other end of this link is at Cassel in Northern France.

A compact Continental Control Centre has been established in Broadcasting House, London. The function of this is to provide the additional facilities required when making contributions to or accepting items from the European television network. These facilities include the selection and level control of incoming and outgoing vision signals, the origination of test signals and of opening routine captions, for which a transparency scanner is installed. Elaborate arrangements are provided for handling simultaneously several commentaries in different languages and for the routing of the associated control circuits. Identification announcements recorded on continuous tape loops in ten languages can be sent to the various lines prior to the commencement of an outgoing program.

A specially designed vehicle has been put into service, primarily to provide facilities for foreign commentators at outside broadcasts in this country which will also be distributed over the European network. Initially, outputs from six foreign commentators' microphones could be sent to the BBC Continental Control Centre and thence to the countries concerned. The number of separate commentary channels is now being increased to 15, plus four channels for sound effects.

A radio microphone has been developed by the BBC, and several of these are now in operational use in the Televison Service. The output of the microphone itself, which may be either of the button or baton type, is taken to the modulator of a miniature FM transmitter operating in Band I with a peak deviation of 75 kc. This transmitter measures $3\frac{1}{2} \times 3 \times \frac{3}{4}$ in. approximately, and its battery supply measures very slightly more, both transmitter and battery supply being easily concealed in the clothing of the wearer. The output of the transmitter is about 250 mw and is radiated from an aerial consisting of a length of flexible wire, which is also concealed in the clothing. A lightweight receiver has also now been designed for operation with the radio microphone. The quality of sound reproduction obtained from this miniature radio microphone equipment is very satisfactory and its use is rapidly extending.

Synchronous operation between outside broadcast and studio sources has now become standard practice, and equipment has been installed at the London Studio Centre which will accurately lock the local timing signals to those generated by the outside broadcast equipment. By this means, rapid cross-fades and mixes or cuts can be made between the two sources without temporary loss of frame synchronization.

Considerable expansion took place in 1955 in film camera, processing, editing and reproducing equipment, both in connection with the BBC "News and Newsreel" service and in the main film unit itself. A model for the prototype of a double-film camera was designed and produced by the BBC and manufacture of these new cameras is now proceeding. These cameras use separate picture and magnetic sound recording films which are run simultaneously. They may be either both 16mm or both 35mm. The results produced are of high grade, and it is intended that they should be used for filming sequences for BBC TV films and for inserts into studio and outside broadcast programs.

Four Staticon telecine equipments, two for 16mm and two for 35mm film, and an opaque caption scanner also using a Staticon camera have also been installed for the presentation of "News and Newsreel." An experimental introduction has been made of magnetic stripe sound for newsfilm. This consists of a stripe of magnetic soundtrack material applied to 16mm films in the space normally occupied by the photographic soundtrack. If the experiment succeeds, it will result in a considerable improvement in the sound quality from 16mm news film.

The recent purchase by the BBC of Ealing Film Studios will result in considerable expansion of the BBC Television Films Dept. The planning for the new center will make use of existing facilities as far as possible, and therefore will involve the minimum alteration to the premises and so will enable an early start to be made on production work. The final facilities will include filming stages, dubbing theaters, editing rooms and review suites.

High-Speed Photography

The subject of high-speed terminology received attention during this year in two approaches. A thoughtful article by St. Thomas[101] examined the subject of photographic instrumentation and the manner in which its work is reported. In his article "Photographic Instrumentation: A Proposed Terminology for Codification" he cited the work initiated by the late Kenneth Shaftan toward organizing the search for pertinent information of interest to workers in this field. The second approach consisted of publication of a tentative listing of definitions in the field of high-speed photography by Morgan and Waddell.[102] This listing was discussed by the SMPTE Engineering Committee on High-Speed Photography during its meeting in October 1955.

Applications of high-speed photography and of specialized types of photographic instrumentation at the Air Force

Missile Test Center, Florida, were discussed by Price and Ehling.[103]

A recently developed type of ribbon-strip camera for obtaining successive tracked images of an airplane in flight was described by Fairbanks.[104]

Continuing interest in the field of underwater photography by Edgerton has resulted in his development of a novel 35mm camera and flash unit which are encased in cylinders.[105]

Evaluation of various types of incandescent lamps when operated at high voltages for high-speed photographic illumination was outlined in a paper by Novajosky,[106] while applications of internal timing systems to Fastax and Traid 200 type cameras were described by Blake.[107]

The Boeing Airplane Co. is using a modified 16mm Fastax camera to obtain simultaneous high-speed schlieren images and dynamic data such as pressures or temperatures from a two-channel oscilloscope in explosion studies, as reported by Hays.[108]

A new Beckman & Whitley Model 216 Pressure-Transient Recorder, a Kerr-cell instrument developed by the Hycon Mfg. Co., and developments in the field of electronic light amplification are described in a review of 1954 photographic progress by Frank Smith in *Photographic Engineering*.[109]

Further data on studies of reciprocity-failure effects in determining exposures when using electronic flash equipment are given in a paper by Grimm.[110]

Continuing development of improved techniques and equipments for assessing metric photographic records was indicated by the presentation of four papers on this subject at the 78th Semiannual Convention of the SMPTE during October 1955. The High-Speed Committee of the Society discussed in its October meeting plans for the Third International Congress on High-Speed Photography, scheduled for Sept. 10–15, 1956, at London.

Beckman and Whitley introduced their high-speed rotating Drum Camera capable of speeds from 4 to 400 ft of film per second. The Traid Corp. finished development on their Traid 500 camera.[111]

The Armed Forces

A Committee reporting on advances made by the Armed Forces during 1955, said that while a number of things were being worked on at the present time many of them were either secret or not ready for reporting at this time. However, the Committee did state that the 120-theater circuit of the Far East Army and Air Force Motion Picture Service has been plagued by rising costs and operating personnel shortages. The application of a new semiautomatic dual pushbutton controller for motion-picture projectors achieves maximum centralization of all the operational controls to facilitate handling by one military projectionist. One button on the controller connects power to the incoming arc, which must be manually struck, and another button starts the incoming projector motor via a sequence-type, stepping relay, which in turn effects changeover via thyratron delay circuits. Other delay circuits shut off arc and motor of the outgoing projector after appropriate intervals, and set up the relay circuits for the next changeover in the opposite direction. Overriding pushbutton controls are provided for all automatic functions to allow for emergency, or nonstandard operation. New custom-designed Perspecta integrators combine provisions for simplified operation, complete emergency switching to prevent sound failure, and extreme service accessibility.[112]

The Office of Armed Forces Information and Education, Department of Defense, has expanded its program of very low powered TV broadcasts at certain isolated military bases. Each television station covers an area sufficient for

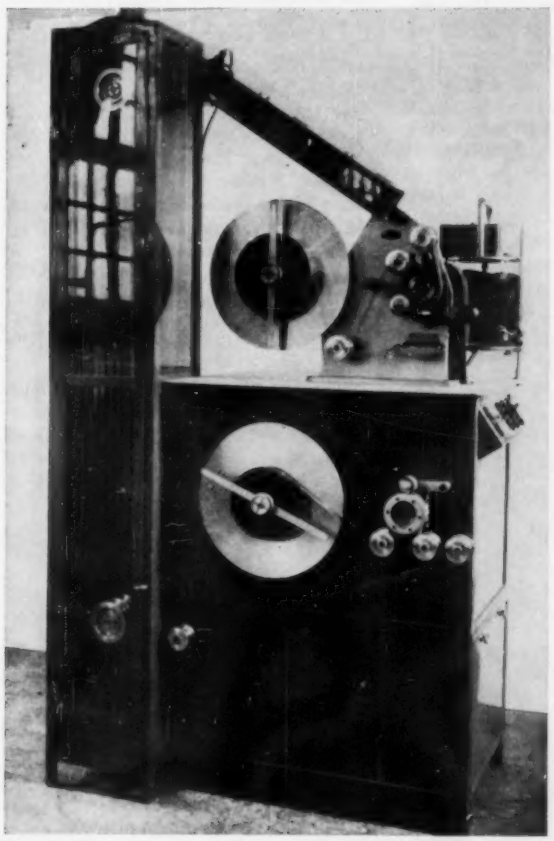

Fig. 42. CinemaScope striping machine of the Ferrania Film Co.

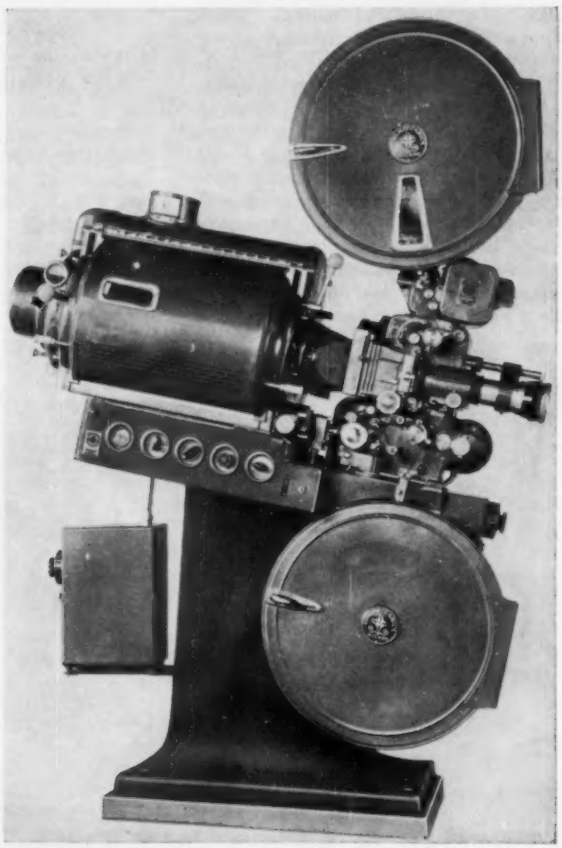

Fig. 43. Cinemeccanica Victoria VI/C projector with anamorphic lens and penthouse magnetic reproducer.

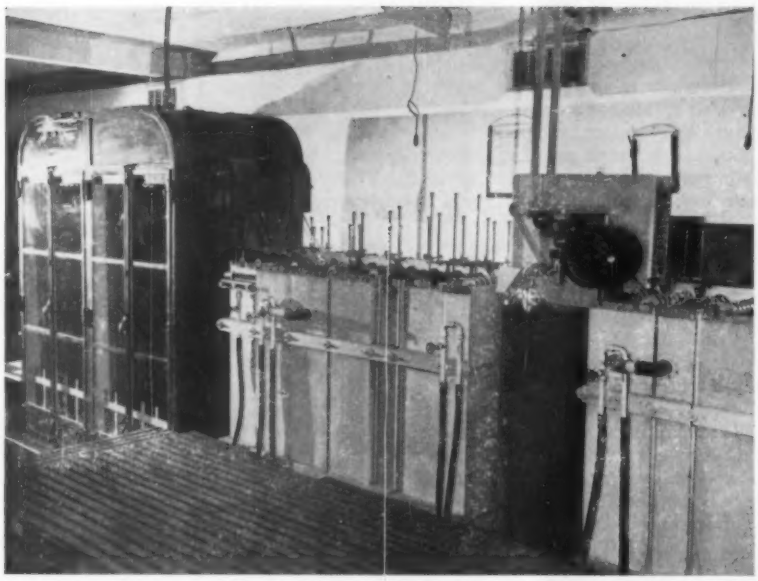

Fig. 44. Developing machine for Eastman color positive showing bleaching, washing and drying sections. The device seen on top of the machine on the right is the appliance for redevelopment of the soundtrack.

the military population and their families. Eleven stations now in operation include: Loring AFB, Maine; Lajes Field, Azores; Wheelus Field, Tripoli; Keflavik Airport, Iceland; Thule Air Base, Greenland; Dhahran, Saudi Arabia; Kindley AFB, Bermuda; Kagnew Station, Eritrea; Clark AFB, P.I.; U.S. Naval Base, Guantanamo Bay, Cuba; and Kadena AFB, Okinawa. Early in 1956 two additional stations in Greenland, and one station in Panama Canal Zone will be established. Three low powered radio broadcasting stations will go into operation in Alaska. These television broadcasts have proved to be an effective morale builder for military personnel and their families while on duty at these remote locations.[113]

Special Technical Progress from Italy for 1954

The progress report from Italy for 1954 was delayed in arriving and it could not be included in the 1954 report. However, the report should be of interest to anyone in the motion-picture business and it is therefore presented here.

Film Emulsions. The Ferrania Film Co. has further improved the quality of its Ferraniacolor negative type 82, with exposure index of 20 ASA, which is used both for tungsten and daylight without filters, color compensation being obtained in printing. Ferrania manufactures also a color negative of lower sensitivity, Ferraniacolor type 51, with exposure index 10 ASA, of very fine grain which can be developed at high contrast for special purposes.

The "invertible" Ferraniacolor 95 is in wide use in Italy for obtaining color dupes, for opticals as well as for dupes for release printing and protection purposes. A new fine-grain sound recording negative with the designation Ferrania SAV-GF has been put on the market.

For 16mm film a negative material called Ferraniacolor type 54 has been made available. The 16mm Ferraniacolor positive can be used both for printing from this new negative and for reduction printing from 35mm negatives and dupes.

Ferrania produces now 35mm magnetic raw stock for sound recording and has installed at its factory a machine for striping the CinemaScope multiple tracks on CinemaScope prints. Magnetic striping is done also on 16mm and 8mm films.

Figure 42 shows the 35mm striping machines of the Ferrania Film Co. Striping is done in Rome also by a branch of the French Company Pyral.

The "Electrical printing" of sound on the finished CinemaScope prints is made at some dubbing studios in Rome. "Fono Roma" is equipped with printing machines which can print two reels at the same time, while Titanus can handle a single print on a Westrex machine.

CinemaScope Projection. Equipment for CinemaScope projection is manufactured now by all Italian manufacturers of projection equipment: Cinemeccanica, Microtecnica, Prevost, Pion, Fedi, etc. Figure 43 shows a Cinemeccanica Victoria VI/C projector with anamorphic lens and penthouse magnetic reproducer. The arclamp has a 420mm mirror. All the components of this equipment are now manufactured in Italy, including the multiple magnetic heads and the anamorphic lenses (see below, under "Lenses").

Some of the major Italian manufacturing companies have considerable research facilities and very up-to-date machine tools. A visitor from U.S.A. would be agreeably suprised to see in the Cinemeccanica testing rooms a self-made flutter measuring instrument used for current tests on soundhead performance and in the machine shop every gear being rectified with elaborate Gleason Machines.

About 800 theaters in Italy already have CinemaScope installations, but several hundreds more have placed orders for this type of equipment.

Screens. Metallized plastic screens are currently manufactured in Italy.

Lenses. The manufacturing of projection lenses has made considerable progress. By special arrangement with 20th Century-Fox the Galileo Co. of Florence

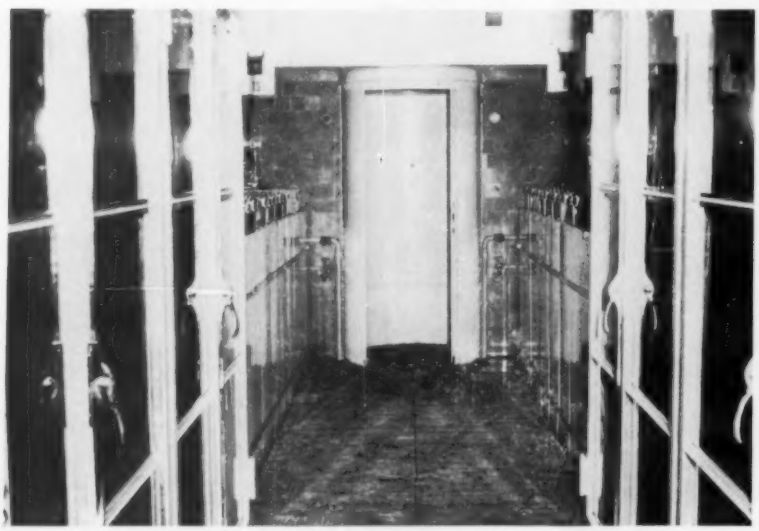

Fig. 45. ARRI color developing machine at Tecnostampa.

and Milan manufactures Hypergonar anamorphic lenses.

Also in the manufacturing of ordinary projection lenses, considerable progress has been made. The new Galileo line of six element lenses, called "Esacine" with all the characteristics of anastigmatic lenses gives better performance than the four-element lenses previously used.

Perspecta Sound. Perspecta sound has been introduced on the Italian market by M-G-M with its recent pictures *Knights of the Round Table*, *Rose Marie*, and *Student Prince*, etc. The leading manufacturers of motion-picture equipment have purchased from Perspecta Sound, Inc., a license for the manufacturing of integrators.

Film Laboratories. Considerable progress has been accomplished by film laboratories, which have concentrated mainly on color problems. Large laboratories, like SPES or Tecnostampa can handle Eastmancolor negative and positive, Ferraniacolor negative and positive and Gevacolor. Figure 44 shows the darkroom sections and end sections of developing machines in use at SPES for Eastmancolor processing. In positive processing the soundtrack is redeveloped for Eastmancolor (Fig. 44) whereas dyetracks are used both for Ferraniacolor and Gevacolor. These machines were all designed and built by the technical staff at SPES.

Figure 45 shows "Arri" color developing machines used at Tecnostampa. These machines, built by Arnold & Richter in Munich, are gaining increasing popularity in Italy. The tanks for these color developing machines are now usually built in such plastic materials as polydurit or vinydur, although some laboratories have preferred stainless steel, with the exception of tanks for the bleaching solutions. A large proportion of the conduits for circulation of the various solutions are also made of plastic materials. Heat exchangers are normally built in stainless steel.

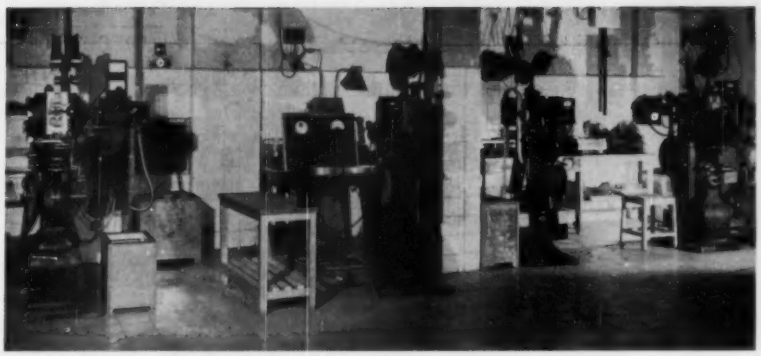

Fig. 46. Debrie color printer at SPES.

The importance of efficient temperature control and of a high rate of circulation are now realized by all laboratory technicians. The rate of circulation in color processing machines is now subject to constant control by means of conical flowmeters.

For color printing normally Debrie printers of the latest model are used (Fig. 46) although up to this moment little use has been made of the additive color balancing method. Italian laboratories still prefer to use a color correction strip incorporating subtractive filters.

High-speed machines for black-and-white release printing have been developed by the SPES laboratory, which also sold a few to other laboratories. Figure 47 shows one machine of this type, which was tested at a speed of 13,000 ft per hour, but is normally operated at a speed of 8000 ft. The machine inverts the film direction at the end of each reel, and it incorporates automatic devices for the cleaning of picture and sound negative. The light changes are effected automatically by means of a traveling control strip.

Figure 48 shows some of the auxiliary machines used at large laboratories, like SPES. They are, left to right, a reconditioning machine for old negatives, which eliminates bad scratches by means of a light grinding action, a film cleaning machine and a machine for lacquer coating, for color negatives.

Color sensitometry has made considerable progress. The devices used for this purpose are either the Ansco Macbeth densitometer, or the Westrex RA 1100 modified densitometer. Chemical analysis is used as a continuous check on the solutions, with some laboratories using also spectrophotometers like the Hilger instrument (SPES), pH meters, and in some cases recording pH meters like recording thermometers are currently used.

Silver recovery is now universally made with electrolytic methods. Recently the Arri silver recovery machine, which introduces high agitation in the hypo solution during the electrolysis has been installed in some laboratories.

The joint capacity of the Rome laboratories in color processing is of about 15,000,000 ft of color positive monthly and of about 3,500,000 ft of color negative.

For dupes the Ferrania invertible rawstock (Ferrania 95) is largely used, but some laboratories like Tecnostampa have recently introduced the use of color separations and internegatives on the

Fig. 47. High-speed continuous printer for black-and-white release printing.

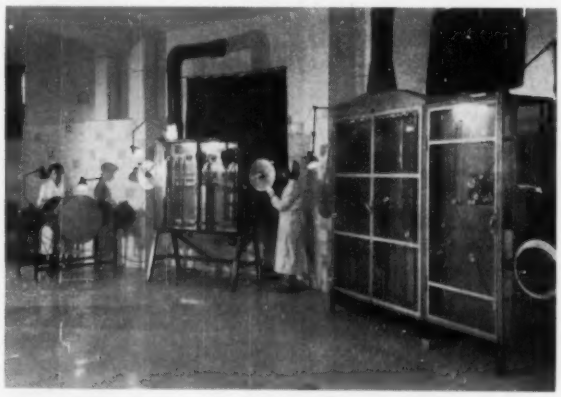

Fig. 48. Machine for the reconditioning of old negatives with a glass wheel, cleaning machine, and lacquer-applying machine (left to right).

Eastman Kodak films 5216 and 5248. The speed of this operation is still rather modest, due to the high registration requirements of the step printers used for this purpose (which normally incorporate Bell & Howell movements) but it is expected that experience and the use of more powerful light sources will soon enable our labs to pass from their present speed of 5 frames/sec to higher speeds.

Australia

From Australia our correspondent reports: Six television stations are now being constructed in this country, three in Melbourne and three in Sydney, one of each of which will be reserved for noncommercial use by the Australian Broadcasting Commission who are going ahead faster, it would seem, than even the commercial stations.

Predominantly English and German television equipment is being purchased but motion-picture equipment is coming mainly from America since the best equipment in this field cannot be obtained elsewhere. The development of television will start the organization of a full-fledged motion-picture industry in this country. Heretofore only small units have been functioning. The firm Artransa is constructing two large sound stages, installing animation and special effects equipment and will provide a complete service in the production of commercials and film programs for television.[114]

General Report from Japan

In recent years the motion-picture industry of Japan has been growing at a tremendous rate. Today they are reported to be in a dilemma because of the problems of producing quality films, such as *The Gate of Hell*, which they can export, and working to shooting schedules aimed at filling theater screens with multi-feature shows every week in their own country. At present each major Japanese studio pushes through one cheap picture after another, allocating on an average of $50,000 to a picture for production and $40,000 for distribution. The studio feels lucky if it finds time for 10 quality films a year, two or three of them good enough for export. By 1954 the major studios, plus 31 independents were turning out 330 movies a year. The prize winning Japanese films have been especially notable for their use of color and to date they have been shown on Eastman color although there have been experiments with Fujicolor. Many Japanese movie theaters are equipped to show CinemaScope and other big screen films.[115]

Report from West Germany

The following section presents a brief report on the status of motion-picture engineering and the new developments that have taken place in the industry in West Germany during 1955. Since the report was prepared by the German Society of Motion Picture Engineering, only those companies are included which are members of the Society. On this account the report makes no claim to be comprehensive. It is based on releases and announcements from the various companies, and also on articles published in the technical literature (*Filmtechnik* and *Filmtechnikum*).

The year 1955 was particularly noteworthy as the 60th anniversary of the beginnings of the motion picture. Sixty years before, Max Skladanowski in Germany was showing his first living photographs in the Berlin "Wintergarten." Similar demonstrations were being given during the same period in France and the U.S. A special issue of *Kinotechnik* contained a number of historical papers devoted to the anniversary.

Another high point of the year was the ISO meeting in Stockholm in June, at which a group of 12 leading motion-picture engineers from Germany were present. Details of this meeting may be found elsewhere.

The outstanding feature of the period under consideration was the rapid development of wide-screen processes. Of the 5659 motion-picture theaters in West Germany some 2100 had been adapted for wide-screen presentations by the end of the year, while a third of these were equipped for 4-channel magnetic sound reproduction — the smaller proportion being due to the cost of such installations, which is considerably higher than that of the equipment required for showing large pictures only.

The economic position of the industry, especially as regards film production, was adversely affected by the decentralization and fragmentation of the UFA Company.

Brief reports follow, gathered from the technical literature during the year, on:

(1) raw stock;
(2) picture taking;
(3) laboratory processing;
(4) projection;
(5) standardization.

Raw Stock. Agfa introduced a new Agfacolor negative film Type 3, for use without filters in daylight or artificial light. At $f/2$, this film requires 200 ft-c for daylight pictures and 400 ft-c for artificial light. It was used for some 30 feature pictures and for a considerable number of industrial, advertising and documentary pictures in 1955. Color correction is achieved in the printer without loss of balance. The gamma values of Type 3 film and its corresponding positive, Type S, conform to accepted international standards, so that other types of negatives can be printed on Agfacolor positive and vice versa.

A new 16mm reversal film, Isopan/SS, with a sensitivity of 19/10° Din, was announced by Agfa.

Picture Taking. The Arricord 35, a new combined picture and sound 35mm camera, was introduced by the firm of Arnold & Richter in Munich. This camera combines the well-known Arriflex with a magnetic sound recording unit, and is housed in a sound blimp. Feed and focusing can be controlled from outside the blimp, and the camera can be powered either by a 24-v drive motor connected with a battery or by a 220-v synchronous motor plugged into a power line. Sound can be directly monitored from the tape. Carrying cases are provided for camera, battery and amplifier.

Studio lights with a capacity of 20 kw are available from three different companies. The lamp diameter is about 380mm and a light output of 60,000 lm is claimed.

Development in sound recording has been exclusively concerned with magnetic sound processes, with emphasis on stereophonic sound. Amplifier units are of the button-on type (penthouse). The 2-track stereophonic system has been completely abandoned. Miniature-size magnetic soundheads are available with 8mm cores, or 12mm with mu-metal casing. One firm stripes 16mm film for magnetic sound by milling out the film and applying a strip of adhesive film of suitable width with magnetic track on it.

Laboratory Processing. Equipment for turning out multiple prints of magnetic soundtracks was announced by Siemens & Halske-Klangfilm. This unit, the "Copycord," is capable of printing four magnetic tracks from a master printer to any number of subordinate units which are electrically intercoupled. This firm also brought out a new 6-channel re-recording console.

Further details about Siemens & Halske products need not be given here, since Dr. Wohlrab gave fairly full information about them during his visit to the U.S. in 1955.

A re-recording console for stereophonic sound and an editor were also announced by Bavaria Filmkunst, GmbH, of Munich.

UFA-AFIFA introduced a new title stamping unit for putting subtitles on black-and-white and color film. The titles are prepared chemographically and stamped onto the film where they are bleached out by chemical means. The film is first given a thin coating of wax, which receives the impression.

Editors with anamorphic lenses were available for editing CinemaScope films.

Projection — Picture. Zeiss Ikon equips its projectors with xenon lamps if required. Type XBO 1001, at 45 amp, gives 2800 lm; Type XBO 2001, at 70

amp, gives 5200 lm. The second of these lamps is intended for wide-screen projection. The xenon lamps are said to have a life of 850–950 hr.

Mass production of a new high-intensity projector, Type FH 99, was begun by Frieseke & Hoepfner, GmbH, Erlangen-Bruck. Wide-screen projection in open-air theaters was successfully accomplished with this projector, e.g. in July 1955 in Passau. Screen dimensions on this occasion were 28 × 11 m (308 sq m), with an 85-amp arc. The diameter of the reflector is 540 mm.

The same company introduced a new projection window combining projection and inspection ports.

Additional anamorphic lenses for projecting wide-screen pictures came from Zeiss, Oberkochen; I. D. Möller, Wedel/Holstein; and ISCO, Göttingen. I. D. Möller also brought out a 16mm anamorphic lens that can be used for taking as well as projection.

Projection — Sound. Projectors without exception are equipped for reproducing magnetic soundtracks. The amplifier unit is generally of the button-on type, permitting smaller theaters to add to their equipment as desired. Sound equipment of this type for 4-channel magnetic and single-channel optical tracks was introduced by Telefunken as their Type MS 11. Similar equipment intended for CinemaScope projection was announced by TE-KA-DE.

Loudspeakers with increased resonance, and a diaphragm-less speaker developed from a French patent and named the Ionophon, were introduced by Telefunken. In the latter speaker sound is produced in an ionized air gap. Since it contains no diaphragm and hence no moving part it is claimed to give excellent reproduction independent of frequency.

The Philips company developed new equipment for the hard of hearing for use in theaters. The sound waves pass through an extensive cable network installed in the theater and are received by means of a small induction coil in the individual viewers. Strength can be adjusted by turning the viewer coil.

Standardization. As stated above, a delegation of twelve engineers from West Germany was present at the ISO meetings in Stockholm, and considerable attention was given to the German proposals. Seventeen working groups were established to work on current standardization problems. The following approved standards were issued during 1955:

(a) Cinematography

DIN 15 501 Raw stock dimensions for 35mm negative and positive film.

DIN 15 551 Safety film — definitions, testing, identification.

DIN 15 571 (1) 35mm film projection in reconstructed theaters; screen brightness values.

——— (2) 35mm film projection in reconstructed theaters; screen brightness measurements.

DIN 15 580 (5) Motion-picture nomenclature for 35mm film processing.

DIN 15 601 16mm film perforated one side; raw stock dimensions.

DIN 15 625 16mm film, 8-, 12-, 16-, 20-, 24- and 32-tooth sprocket wheels.

DIN 15 651 16mm film, perforated both sides; raw stock dimensions.

(b) Magnetic Sound

DIN 45 510 Magnetic recording and reproducing, definitions.

DIN 45 511 Magnetic recording and reproducing, use of tape recorders.

DIN 45 512 (1) Magnetic recording and reproducing, equipment, tape, mechanical specifications.

DIN 45 513 (1) Magnetic recording and reproducing, tape recorders, tape DIN-76 (for 76.2 cm/sec).

——— (2) Magnetic recording and reproducing, tape recorders, tape DIN-38 (for 38.1 cm/sec).

——— (3) Magnetic recording and reproducing, tape recorders, tape DIN-19 (for 19.05 cm/sec).

——— (4) Magnetic recording and reproducing, tape recorders, tape DIN-9 (for 9.53 cm/sec).

DIN 45 514 Magnetic recording and reproducing, equipment; reels.

DIN 45 515 Magnetic recording and reproducing, equipment; cores.

DIN 45 519 (1) Magnetic recording and reproducing, tape recorders, tape measurements.

——— (2) Magnetic recording and reproducing, equipment, tape dimensions, signal-to-noise measurement.

The following proposed standards were published during the year:

DIN 15 655 16mm magnetic sound film perforated at one side, raw stock dimensions.

DIN 15 825 8mm film, 12-, 16-, 20-, 24- and 32-teeth sprocket wheels.

DIN 15 851 8mm film, raw-stock dimensions.

DIN 45 512 (2) Magnetic recording and reproducing, equipment, electroacoustic properties of magnetic tapes.

TV and Motion Pictures. Due to its preoccupation with economic reorganization and the nature of its technical connections with television the German motion-picture industry has not taken any particular initiative. The use of film as TV program material continues to increase in importance, particularly in the form of 16mm newsreels. Experiments have been carried out with 8mm film with some success for particular applications, but results do not lead to the conclusion that 16mm film can be replaced with narrower films. A detailed description of developments in this field will be included in the 1956 report.

Conclusion

The Chairman wishes to express his thanks to the Committee members and all others who supplied material for this report.

No doubt there are items which should have been, but have not been, reported. In some cases it is the fault of the Chairman and in others it was a lack of response from those who were asked to submit material.

The Committee

Lloyd Thompson, *Chairman*

J. E. Aiken
Walter Bach
Frank G. Back
H. L. Baumbach
G. M. Best
F. L. Bicker, Holland
Rudy Bretz, Australia
Phil Brigandi
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E. L. E. Pawley, England
Ben Perce
J. L. Pettus
Cameron G. Pierce
V. Prem, India
Hazard E. Reeves
Edward H. Reichard
Fred Rich, Australia
W. C. Rubinstein
Loren Ryder
E. H. Schreiber
Johannes Schunack
Earl I. Sponable
Malcolm G. Townsley
Joseph S. Tushinsky
Petro Vlahos
D. R. White

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Effects of Visual Angle on Visual Perception

By SIDNEY M. NEWHALL

If the visual angle subtended by an object is varied, as by varying the viewing distance, the appearance of the object may also change. Appropriate comparisons can reveal obvious changes as in perceived size, perceptible detail, eye-comfort, apparent color and realistic effect. There are, however, a number of factors in commercial motion-picture viewing situations which tend to minimize differential effects of visual angle on motion-picture perceptions.

THERE ARE numerous known psychological effects associated with the variation of visual angle, the angle subtended at the eye by any centrally fixated object of vision. Some of these effects are familiar, some may be surprising, and all of them are demonstrable under certain conditions. The extent to which these effects would become manifest in commercial motion-picture viewing situations, however, is quite a different story. Commercial motion-picture viewing situations are generally much less sensitive than experimental laboratory situations specifically designed to detect small changes. Consequently, effects established as significant in the one type of situation could be negligible in the other type of situation. Even a panel or survey-type study of effects could be misleading.[1]

This paper cannot tell how much actual viewers notice, but merely summarizes known effects of experimentally varying visual angle. There may be some interest, however, in regarding all such effects as potential problems; things to look out for in planning pictures or theaters.

Before considering the effects of visual angle, it seems well to illustrate visual angle itself. A visual angle of 20° is represented in Fig. 1. This angle of intermediate size is subtended at the eyes of some customers by the screens of most motion-picture theaters or drive-ins. Note the subtending object or picture at the left, the vertex of the angle at the eye and the retinal image of the object at the right. Of course, normal vision is binocular, so both eyes have visual angles subtended by the same object; and only the one object is seen.

A picture screen is always wider than it is high, even the old aspect ratio being 1.33 to 1. Thus there are often associated with a motion picture two series of visual angles—the approximately horizontal and the vertical. The horizontal angle is of course the larger, and this is the angle to which reference is most commonly made.

Sufficiently extreme variation in visual angle, or almost anything else for that matter, is bound to produce noticeable effects. Consequently, there would be little point in bothering about greater extremes than those to be encountered in motion-picture viewing itself. Motion-picture theaters show great variation in the visual angles subtended for the various viewers by the various picture screens; but a survey of drive-in theaters indicated an overall range from 41° on the front ramp to 4.1° on the rear ramp.[2] Corresponding figures for indoor theaters are 119° in the front row to 11.9° in the rear row.[3] These extremes are illustrated in Fig. 2.

There are several ways of changing the size of a visual angle, viz., changing the size of the subtending screen or picture, changing the distance between the screen and the observer, changing the angle from which the screen is viewed, or some combination of these. The motion-picture viewer can change his visual angle of the picture to some extent by moving laterally along a row of seats; but the more important way at his disposal is by moving more directly toward or away from the screen. Of course it is also possible for the viewer to vary his visual angle by patronizing theaters with different screen dimensions. These changes in visual angle resulting from viewer behavior are important because they afford opportunity for him to note possible related effects. Individual viewers must experience difficult visual angles if they are to be able to notice different related effects.

Relations of visual angle to the two most important determinants are shown in Table I. This presents visual angle in degrees at the left with the picture widths in feet in the body of the table and the corresponding viewing distances in feet across the top. Various relations may be

Fig. 1. Nature of the visual angle.

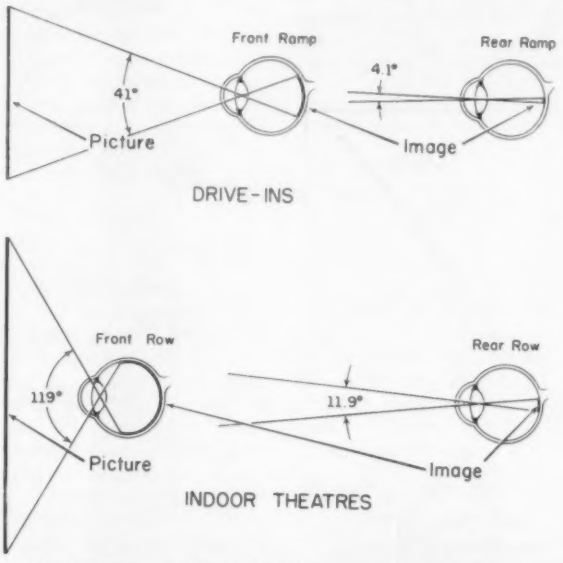

Fig. 2. Ranges of visual angles found in theater surveys.

Presented on October 4, 1955, at the Society's Convention at Lake Placid, N.Y., by Sidney M. Newhall, Color Technology Div., Eastman Kodak Co., Rochester 4, N.Y.
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Table I. Relation of Visual Angle in Degrees to Viewing Distance and Picture Size in Feet.

Visual angle, degrees	Viewing distance, ft from screen												
	10	15	20	30	50	75	100	150	200	300	500	750	1000
1	.175	.262	.349	.524	.873	1.31	1.75	2.62	3.49	5.24	8.73	13.1	17.5
2	.349	.524	.698	1.05	1.75	2.62	3.49	5.24	6.98	10.5	17.5	26.2	34.9
5	.873	1.31	1.75	2.62	4.37	6.55	8.73	13.1	17.5	26.2	43.7	65.5	87.3
10	1.75	2.62	3.50	5.25	8.75	13.1	17.5	26.2	35.0	52.5	87.5	131	175
15	2.63	3.95	5.27	7.90	13.2	19.7	26.3	39.5	52.7	79.0	132	197	263
20	3.53	5.29	7.05	10.6	17.6	26.4	35.3	52.9	70.5	106	176	264	353
30	5.36	8.04	10.7	16.1	26.8	40.2	53.6	80.4	107	161	268	402	536
40	7.28	10.9	14.6	21.8	36.4	54.6	72.8	109	146	218	364	546	728
50	9.33	14.0	18.7	28.0	46.6	69.9	93.3	140	187	280	466	699	933
60	11.5	17.3	23.1	34.6	57.7	86.6	115	173	231	346	577	866	1155
70	14.0	21.0	28.0	42.0	70.0	105	140	210	280	420	700	1050	1400
80	16.8	25.2	33.6	50.3	83.9	126	168	252	336	503	839	1259	1678
90	20.0	30	40	60	100	150	200	300	400	600	1000	1500	2000
100	23.8	35.8	47.7	71.5	119	179	238	358	477	715	1192	1788	2384
110	28.6	42.8	57.1	85.7	143	214	286	428	571	857	1428	2142	2856
120	34.6	52.0	69.3	104	173	260	346	520	693	1039	1732	2598	3464

read from the table, e.g., a picture 35.3 ft wide when viewed from a distance of 100 ft subtends a visual angle of 20°. The picture widths, W, were obtained by the equation $W = 2\ [(\tan \frac{1}{2}A)D]$, where A is the angle in degrees and D is the distance in feet. A number of figures in the upper left and lower right portions of the table are of course beyond the limits of existing screen dimensions. Moreover, all the figures assume normal viewing at the center of the screen and are, therefore, approximate as regards actual theater viewing.

Ten different perceptual effects of variation of visual angle will be described. Usually some correlate of the change in visual angle, rather than the change itself, will be recognized to be the more immediate or critical condition of the visual effect.

Effect on Size

Perhaps the most obvious correlate of varying visual angle is the variation in the size of the retinal image. Unlike the usual flat picture screen, the diameter of the retinal image is an almost linear function of the visual angle throughout the entire range of interest (Fig. 3). Indeed, if the retina were truly spherical with its center of curvature coincident with the nodal point, the relation would be exact.[4] In any case, the retinal image in a viewer's eye in the front row of an indoor theater may have as much as 30 times the diameter of a customer's image on the rear ramp of a deep drive-in. Even moving around in a single indoor theater can vary the image size several diameters. In the Agora Auditorium of the Lake Placid Club, the difference in image width between front- and rear-row viewing is around 3 or 4 to 1, depending on picture size.

Size of retinal image is an important factor in perceived size; and it is easy to demonstrate that changes in the former can produce changes in the latter. As a matter of common experience, many many people have noticed how small the picture screen seems when they are seated far back in a theater.

Effect on Shape

Any object really subtends many visual angles, each angle lying in a different plane extending from object to eye. Changing the angle of view will change these visual angles relative to each other with the result that the shape of the retinal image changes. Movie-

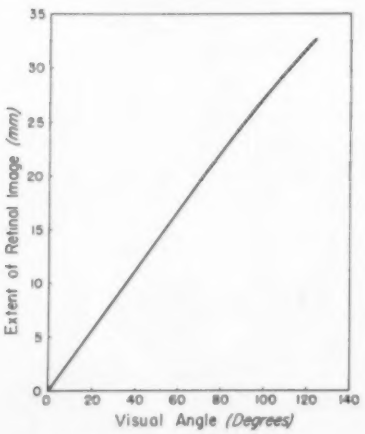
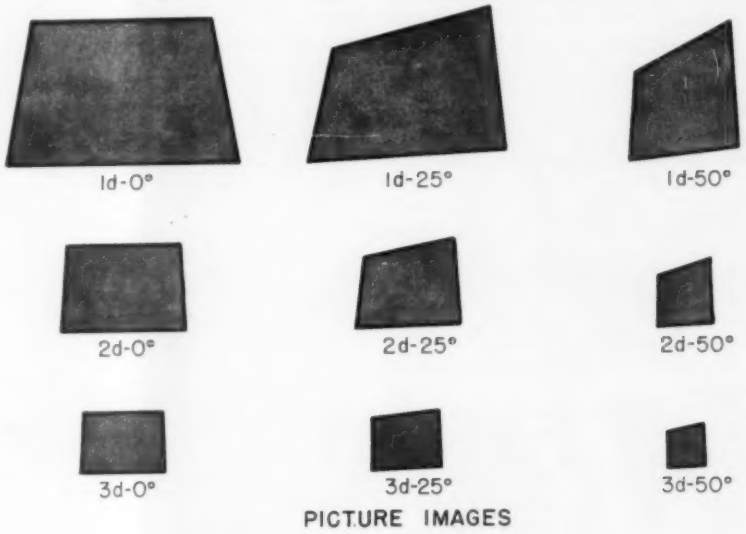


Fig. 3. Size of retinal image as a function of visual angle.



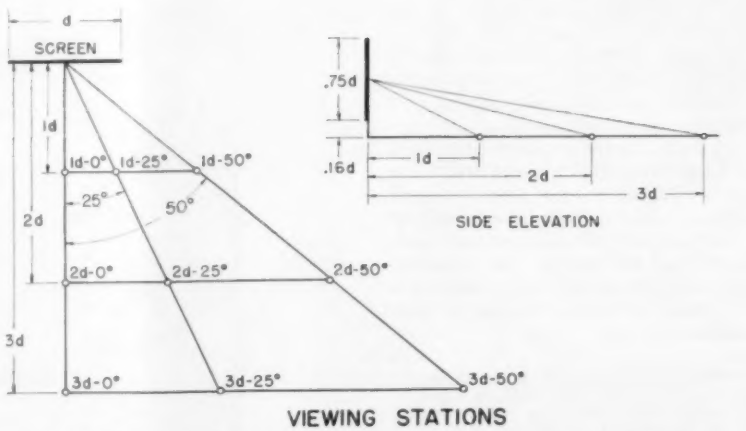


Fig. 4. Shapes of picture projections as related to various viewing stations.

goers obviously see the picture from many angles of view, depending on where they sit. When a viewer moves from a seat on the central aisle to one on an outside aisle, the picture on his retina changes from an approximate rectangle to a trapezoid.

An illustration of distortions of this type is afforded by Fig. 4. This shows the comparative shapes of the plane-projected images of a 1.33-to-1 screen as viewed from nine different stations. As indicated in the figure, these stations include three different viewing angles and three viewing distances for each angle. The projections are realistic; for they assume the observer is viewing the center of a 21- × 28-ft picture with his eyes 4.5 ft below the level of the bottom edge, and at normal distances of 28, 56 and 84 ft. Of course the actual viewing distances are different for all nine stations. If the projections of a wide-angle screen had been calculated, the distortions would have been considerably greater. Perhaps it should be added that lesser changes in shape occur every time a person looks at a different detail of the picture.

Image shape is an important determinant of perceived shape, just as image size is of perceived size. The dependence of object recognition on image shape is constantly verified in everyday experience.

Fig. 5. Loss of detail with increased viewing distance.

Effect on Detail

The perceptibility of picture details tends to vary with the visual angle subtended by the picture at the customer's eye. In other words, capacity to see details improves as the visual angle is increased, as by decreasing the viewing distance.[5] This is on the assumption, however, that the picture contains a range of sufficiently fine detail to be affected. The details of a coarse picture such as a simple line drawing can be resolved equally well at various viewing distances; but the same is not true of a fine complex picture. Figure 5 suggests the obvious loss of detail which can result in the latter type of picture from a reduction of visual angle in such an ordinary ratio as 3.5 to 1. This is the approximate ratio between front and rear viewing in the Agora Auditorium.

In general, the details of the picture which are essential to its story should subtend large enough visual angles to be readily discriminated; otherwise the front rows will be too popular and many customers will be unhappy from frustration or eyestrain. When the viewing of a general scene develops a special area of interest with a craving for higher resolution of details, a close-up of that area may evoke higher satisfaction. The magnification of the close-up may either please the viewer by affording a bigger eyeful of what he wants to see more of, or, less frequently, it may displease him by revealing texture and minor defects.

Effect on Distance

As noted above, some of the effects of visual angle apply within the picture at least as much as to the picture as a whole. The effect on apparent distance is a striking though very familiar instance. Thus if the two objects pictured on the screen at the same moment are known to be of the same actual size, the one which subtends the smaller visual angle is perceived to be the greater distance away.[6] This basic clue to distance applies to geometrical perspective and is constantly operating in the visual environment, in and out of pictures.

Effect on Sharpness

Psychological observers, particularly, are bothered by a lack of focus in backgrounds of color motion pictures. Many scenes which are not supposed to be hazy from twilight or aerial perspective have blurred backgrounds. This would be all right if the viewers fixated only objects of interest in the foreground. The trouble comes when details of the background catch their attention, and these details persist in remaining blurred despite the viewers' accommodative efforts. Although inevitable eyestrain discourages these digressions, they still occur.

Blur tends to become less noticeable, however, toward the back of the theater. This is because decreasing the visual angle by increasing the viewing distance decreases capacity to discriminate detail. Since blue or fuzz of contours constitutes detail, this, along with other detail, should become less noticeable, and so the edges of contours appear sharper. This type of effect has been repeatedly observed. Other things equal, the smaller of two blurred pictures of the same scene is likely to look somewhat sharper. If reducing the visual angle will thus sharpen the background of a picture, the apparent depth of field itself will increase.

Effect on Flicker

Flicker is less of a problem than formerly, but it still merits mention. There are two reasons why perceived flicker may be expected to vary with visual angle; first, the smaller the angle the smaller the actual flicker excursion on the retina; and second the smaller the angle the less peripheral stimulation of the eye where it is known to be most sensitive to flicker.[7,8] In brief, a noticeable physical flicker might well be less noticeable when viewing a picture at considerable distance than when viewing it close up.

Effect on Color

Experiments have shown that all three

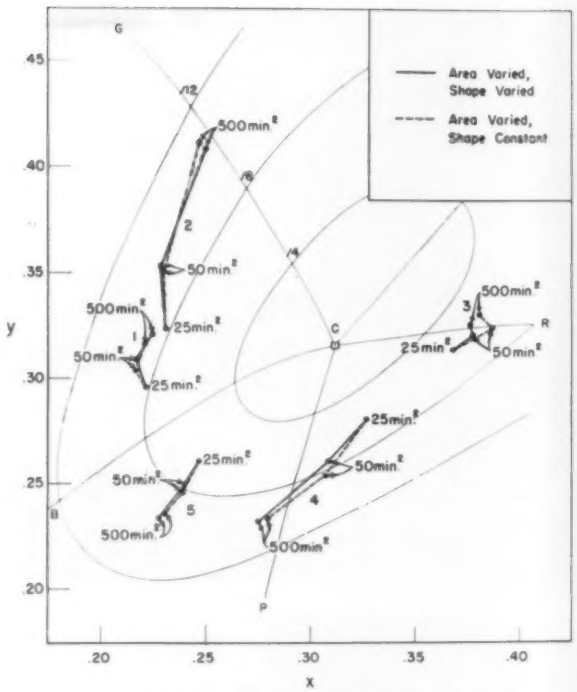


Fig. 6. Relations of perceived color to angular size in the CIE chromaticity diagram.

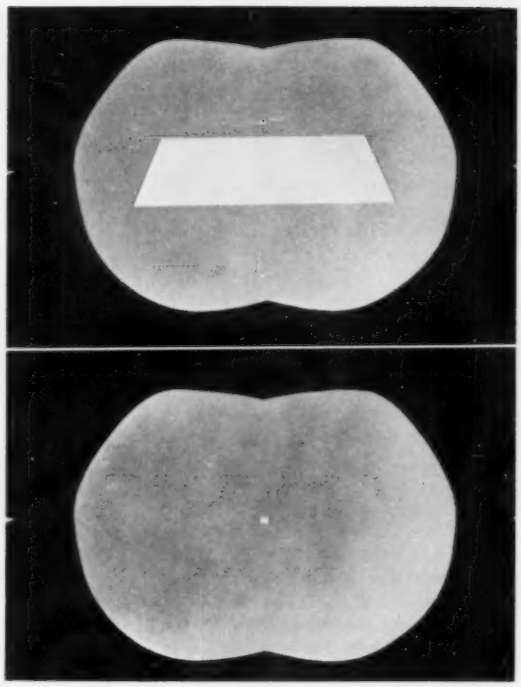


Fig. 7. Maximum and minimum picture projections relative to the total binocular visual field.

of the principal characteristics of perceived color can be changed significantly by changing the size of the retinal image, or, in other words, changing the size of the visual angle. The three principal characteristics are hue, saturation and brightness. Hue is the redness, greenness, blueness or other such distinctive characteristic of the perceived color; saturation is the strength or apparent purity of the hue; and brightness is the apparent luminance. Brightness is here used in the subjective sense and not in the sense of photometric screen brightness.

Continuous relations between perceived color and visual angle were demonstrated by a matching technique with a visual colorimeter.[9] The colorimetric patch of fixed 2° size was used to match the test color in varied sizes. Average results of 7 observers and 5 test colors are plotted in CIE x, y coordinates in Fig. 6. Consider, for instance, the results with the test color number 4 shown below the middle of the figure. The plotted points represent the different colors perceived when the subtended test-color areas were variously 25, 50 and 500 sq min. Except for number 3, the results with all the test colors support the view that the smaller the subtended area of the test color the greater the change in color appearance. A few of the contours of constant hue and chroma of the Munsell renotation have been included in Fig. 6 to facilitate estimation of the considerable changes in hue and saturation.[10]

Another way of stating this is that certain colors which differ obviously in hue may become perceptually identical if the visual angle subtended by the test field is sufficiently reduced.[11] The observer responds as though he had a rare form of color blindness called tritanopia in which blue and yellow are confused, and also colors related to blue and yellow are confused. In one experiment, e.g., observers were unable to distinguish a certain magenta from an orange color when the test field was reduced to a diameter of 12 min. Although the biggest effects seem to come in the small sizes, it is noteworthy that saturation and brightness show some increase with increase in visual angle up to some 20°.[12]

So far as color motion pictures are concerned, then, there is a considerable range of visual angles which might possibly be disturbing. The picture is a pattern of colors of assorted sizes and relationships in which each component color patch subtends a visual angle, large or small. If the perceived color of small patches is more affected by change in visual angle than that of large patches, the perceived color relations of the picture might change with the viewing distance.

Effect on Adaptation

The temporary change in sensitivity to light, due to more or less stimulation by light, is important because it affects both color and brightness perception. An observer in the rear row of a darkened theater is prone to dark adaptation because the bright patch of the picture makes such a small image on his retina. At the other extreme, the picture image of a front-row viewer bulks so large that he cannot avoid considerable light adaptation. In some situations the difference in adaptation may be reduced by the light from exit signs or reflections from car tops or haze.

The comparison in Fig. 7, however, is suggestive of how different the adaptation conditions can be. The tiny light patch at the center of the lower half of the figure represents the relative size of a 1.33-to-1 picture as viewed from the rear of a deep drive-in. This light patch is shown surrounded by and proportional to a silhouette representation of the total binocular visual field which is roughly 130° × 200° of visual angle in extent.[13] Note, in the upper part of the figure, how much larger the light patch due to a 2.66-to-1 picture is, as viewed from the front of an indoor theater.

The contrasting dark surroundings and greater sensitivity of the dark-adapted eye tend to make the small distant screen the brighter screen. On the other hand, the greater light adaptation associated with the near viewing favors somewhat better color rendition.

Effect on Scanning

Since the retinal region of clear vision subtends less than 1° of visual angle, adequate perception of any motion picture whatever demands considerable ocular scanning. This scanning by eye

and head movements is not obviously systematic like television scanning, but seemingly irregular and zigzag, with bias on individual elements of interest.[14] The larger the angle subtended by the picture, the greater the necessary amplitude of the scanning movements. Facing a wide-angle screen down front, eye movements alone will not suffice; head movements also are necessary, and in the more extreme situations considerable changes in bodily posture occur. Thus it appears that the amount of muscular activity and effort required to view a motion picture is a function of the visual angle. Where there is less required activity, there may be more comfort.

The maximum ranges of horizontal scanning movements required for front and back viewing of the 2.66-to-1 and 1.33-to-1 aspect ratios are depicted in Fig. 8. The centrally shaded areas represent 20° subtense. Observations here, which are in accord with those reported elsewhere, indicate that 20° is about the maximum scanning amplitude which can be naturally and comfortably consummated by eye movements alone.[15] Reference to the shaded areas suggests that the indoor theaters require much more bodily movement for scanning than do the drive-ins. Whether there is a corresponding difference in customer satisfaction is unknown.

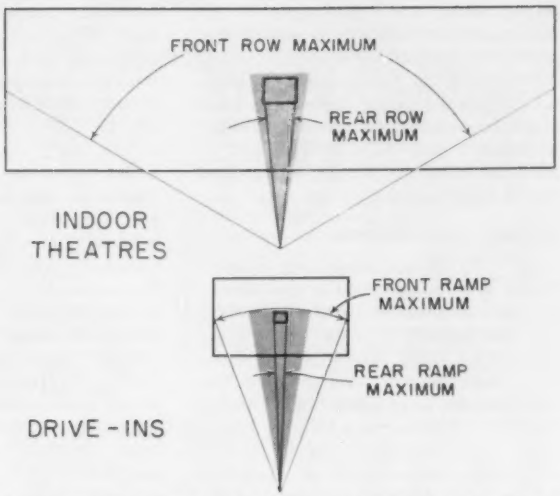


Fig. 8. Amplitude of visual scanning as determined by picture angle. Shaded area represents range of least effort.

Effect on Realism

Experience and promotion have developed an impression of greater reality with the wide-angle screen than with the older conventional screens. Evidently the chief physical basis for greater realism would be the greater "wrap-around." The possible panoramic gain of the maximum CinemaScope aspect ratio over the traditional aspect ratio is indicated in Fig. 9. In new theaters or those which can be converted without sacrifice of picture height, the gain in presented area of subject matter approaches 100%. Of course the screen luminance should be kept up to avoid degradation in discrimination and color rendition.

Further development in the wide-angle direction is found in the arc-shaped Cinerama screen with its angular subtense of 146°.[16] As Fig. 10 shows, visual angles at front seats lying on the chord of the screen arc are as large as 180°. Thus for those in front, maximum "wrap-around" is approached. Rear viewers, however, experience less visual subtense than near viewers of the ordinary wide-angle screens. The only screen which completely fills the field of view regardless of the viewing distance is the Circarama of Disneyland. This has an angular subtense of 360° with the spectators standing about within the cylindrical arena.[17] In viewing a picture of an automobile tour, the spectators look in the forward direction to see the scene unfolding through the windshield; to the sides to see the scenery flashing by the sides of the road; and to the rear to catch the changing view from the rear window.

When a picture extends far out in the viewer's peripheral field, he is less likely to see or think about matters other than the picture; possibly he may feel somewhat as though he were in the picture himself. Possibly, too, the greater scanning movements required to perceive the more widely distributed points of interest contribute to feelings of reality. When such a picture simulates an extended environment, it tends to force from the viewer perceptual behavior similar to that which would be evoked by a

Fig. 9. Gain of subject matter in wide-angle picture.

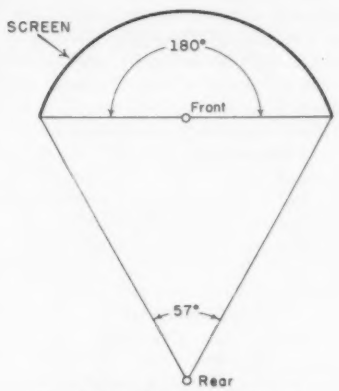


Fig. 10. Maximum visual angle with Cinerama screen.

corresponding actual environment. Adjustive activity incident to almost any perception may arouse sensations which contribute to the perception itself. With a narrower screen or toward the back of the theater where less effortful scanning is required and the viewer is not so hemmed in by the picture, less realism would be expected.

Summary and Interpretations

In order to summarize the possible effects of varying visual angle, assume for a moment that all these effects are of sufficient intensity to bother about in the commercial color motion-picture situation. Then the conclusion could be that the relatively large visual angle of near-viewing or panoramic screen, by allowing the "greater customer participation," yields the greater impression of reality, fuller light adaptation, better color rendition and better resolution of detail. The small visual angle of distant-viewing or narrow screen, on the other hand, would minimize unwanted detail, minor defects, blur and flicker. Moreover, the distant picture could be perceived with smaller scanning movements and more relaxed accommodation. In a word, the act of visual perception might be pleasanter at a distance but more faithful close at hand.

As suggested at the outset, however, the specific effects mentioned above may pass largely unnoticed in ordinary viewing of motion pictures. Occasionally some technical peculiarity is remarked, but generally customers who have secured seats they like seem to accept uncomplainingly the technical aspects of the presentation. There are good reasons why they should do so, and a few may be mentioned here. One reason is the general viewing situation. When viewing commercial motion pictures there is little opportunity for direct perceptual comparisons. About all the viewer could do would be to try sitting at different distances from the screen and to endeavor to remember whether things seemed different from the one location than from the other. Even if the viewer bothered to try such comparisons the continuously changing nature of the motion picture would prevent viewing of exactly the same scene from different distances. It is not at all surprising that sensitive experimental situations where direct comparisons are deliberately arranged can reveal effects which pass undetected in the theaters. Furthermore, the typical viewer in the movie is there to be entertained; he is likely to be following the story and not concerning himself with any such comparisons at all.

A further class of influences which tend to minimize effects of visual angle and almost ensure that they will escape the casual viewer are known as the perceptual constancies.[18] Perceptual constancy means that, with rigorous comparisons avoided, a recognized object tends to look much the same regardless of the viewing conditions. It is as though the observer, not expecting changes in familiar stable objects, is oblivious to such changes. The fact that a color stimulus may vary greatly while the color appearance remains much the same is called color constancy; the fact that the shape may vary greatly while the perceived shape remains unchanged is called shape constancy; and the fact that the size may be varied greatly without much effect on the perceived size is called size constancy. Although all this applies more strongly to actual objects than to pictures, the apparent size, shape and color of the latter are characterized considerably by perceptual constancy.[19] If conditions are made too extreme or the observer tries too hard to see a difference, constancy failures occur. The usual casual viewer, however, tends to be largely immune on both counts.

There is no question that perceptual constancy and the lack of direct comparisons have much to do with the minimization of perceived effects of visual angle. There is also no question that the present rather advanced stage of motion-picture technique has contributed significantly by already taking most of the effects into account. More obvious irritations such as flicker and jerkiness were reduced earlier, and more luxurious satisfactions like better color and realism are receiving later consideration. Much has already been done toward reaching an optimum compromise in adjusting the extremes of visual angle in relation to picture subject-matter.

Even though specific effects of visual angle of the sort summarized may no longer seem obtrusive enough to bother about, there is apparently still room for improvement. Viewers do not need to identify specific effects to be generally affected. If they are vaguely dissatisfied, further study might reveal one or more reasons why—reasons which possibly could be eliminated. Continuing existence of vague dissatisfactions is suggested, for instance, by customer ideas regarding "too near" and "too far back." Why do even persons with normal vision still try to avoid extreme front and rear viewing?

Moreover, the control of visual-angle effects involves the picture as well as the overall angle. This is evident from the fact that different types of pictures or scenes accent the importance of different effects. An action picture, for instance, diverts attention from technical quality and focus and permits greater acceptance of such poor conditions as color imbalance and blur. Similarly, sex appeal or special sports events may cause usual viewers to tolerate lower quality. Where there is special emotional interest, people tend to favor the large visual angle and to be less sensitive to the disadvantages of being close to the screen. On the other hand, pictures with more esthetic appeal may arouse unusually critical attitudes, and the greater tendency to pick up minor technical defects makes more distant viewing preferable. Pictures with much significant and fine detail naturally put a premium on good discrimination, viz., large angle. Obviously the viewing conditions cannot be adjusted to accord optimally with each picture which comes along. There remains the challenge to design all pictures with due regard for the special effects in question.

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Discussion

Anon: Does an integration of your data confirm the fact that the average person prefers a television screen of about 21 in., except in a very large living room?

Dr. Newhall: A 21-in. television screen subtends a visual angle of around 10° at 10 ft and may be the best living-room compromise available at the present time. This could not be confirmed from the data of this study, however, for reasons which I mentioned. The most important reason is that a real test of the situation can be

made only under the actual conditions of interest. Various effects of varying visual angle may be unmistakably demonstrated under particular laboratory conditions, but this is no guarantee that these effects will be evident to usual viewers in a commercial theater or a living room.

Anon: Isn't it extremely likely that the television case is prejudiced by the limit of resolution that appears in a television picture of roughly two-hundred thousand picture elements as against a million or more in a movie?

Dr. Newhall: You are undoubtedly right so far as the resolution problem is concerned. This is persistent enough to be sure of without special testing. The key to the situation is that much of the subject matter presented by motion pictures and television naturally abounds in relatively fine detail. Unless this is resolved physically it cannot be resolved visually.

Ben Schlanger, (Consultant, Audio-Visual Buildings): The ideal viewing distance which includes the distance at which the sense of realism is achieved is found after considering several factors. The spectator ideally should have a viewing angle that is as close as possible to the average camera angle. In accordance with this basic requirement the use of comparatively long focal length camera lenses is not desirable. To avoid waste of seating area near the screen and to place the viewers close enough to the picture to insure picture dominance, an important key to portraying realism, requires the use of shorter focal length camera lenses. These lenses are available, but it seems to take some time for them to be adopted in cinematography.

The valuable viewing areas near the screen can best be exploited when resolution of picture detail is satisfactory for the closer viewing distances. Horizontal projection VistaVision, contact print CinemaScope 55 projection, Cinerama and Todd A-O projection offer this quality of resolution.

The extra eye and head movement required for the comparatively close viewing distances does not become annoying to the viewer unless the cinematographer spreads the focal points of interest without meaning and purpose. The occasional placing of action to the extreme sides of the image is, as a matter of fact, a device for special emphasis and it produces real life experience parallels.

These developments indicate an optimum maximum viewing a distance of approximately one and three quarters times the projected picture width. Greater viewing distances may be acceptable but will not produce the dramatic effect needed in the indoor motion-picture theater which must offer a really contrasting quality of performance as compared with home television where picture dominance is as yet a long way off.

Anon: I agree with the probable importance of the scanning movements, the greater breadth of scanning movements in the wide-angle screen contributing to the illusion of reality; I think that it probably does because, as you say, we're doing much the same thing there, as far as viewing behavior goes, as in an actual situation. Also I agree with the shape of the auditorium. I should think it very likely that the effect of realism would fall off with increase in viewing distance and reduction of visual angle as you go toward the back of the theater. I've looked at the Cinerama myself and that's the impression I get; it's just the impression of a single person going back and forth. It does seem very reasonable that with an angle of only 57° at the back as compared with 180° at the front, you would get something quite different.

New Paramount Lightweight Horizontal-Movement VistaVision Camera

By C. R. DAILY

A lightweight double-frame motion-picture camera has recently been developed for use on locations which require extreme portability. It weighs only 17½ lb, complete with motor and a loaded 400-ft film magazine. A positive registration movement provides steady operation equal to that obtained with the heavier duty VistaVision cameras. Dependable operation is being obtained with a minimum of maintenance. Lenses from 28mm to 150mm are provided.

TWO YEARS ago Paramount adopted the double-frame VistaVision system of large negative area photography in order to provide a much higher quality picture to theaters. The improvement in quality was particularly noticeable in theaters which were using much larger screens. The heavy-duty production cameras, which were designed for this purpose, did an excellent job but there remained the urgent need for a lightweight camera which could be used on difficult location assignments. These included helicopter and other aerial work, mountain locations, small boat work and many other applications where weight and portability are at a premium.

A location camera should have a precise registration-pin type movement because it is frequently desirable to shoot plates on location which can later be used with background projection. A careful study of the intermittent movement of the Mitchell double-frame camera indicated that it could be adapted to form the basic element of a lightweight camera. Combining this movement with a new case, magazine and simplified gear system design, an entirely new camera evolved which met all requirements for registration, light weight and ease of handling.

The trend in the industry is toward larger area negatives; therefore, it is important to note that this new camera is the *first* camera to be designed for professional motion-picture production which combines the merits of very light weight, a precision movement and a larger frame area. Other large-film systems will need to adopt the essential features of this camera if their location photography is to be done with the ease and quality that has been demonstrated here.

Fig. 1. Lightweight VistViasion camera.

The new camera is easy to handle. As illustrated in Fig. 1, it can be hand-held, if necessary, since it weighs only 17½ lb. It has already had extensive production use, including rugged field service in the Alps on the production *The Mountain*. Background transparency plates made on this location were absolutely steady and have already been used in the finished production, being projected up to a width of 28 ft on the transparency stage.

Paramount has also used the new camera on the productions *Pardners* and *Anything Goes*, and several more cameras are being built. The Stanley Kramer Company has taken one to Spain and the J. Arthur Rank Organization is building one.

Double-Frame Operation: This new lightweight camera operates in the same manner as the heavier duty VistaVision cameras which were placed in service over a year and a half ago. Regular 35mm film is used, with the film moving on edge through the aperture. The film moves from right to left through the camera, as viewed from the rear, with an 8 sprocket hole pulldown. The regular VistaVision camera aperture of 1.481 × 0.991 in. is exposed.

Movement: The movement is of the Mitchell type, with registration pins on

Presented on October 3, 1955, at the Society's Convention at Lake Placid, N.Y., by Loren L. Ryder, for the author, Paramount Pictures Corp., 5451 Marathon St., Hollywood 38.
(This paper was received on March 26, 1956.)

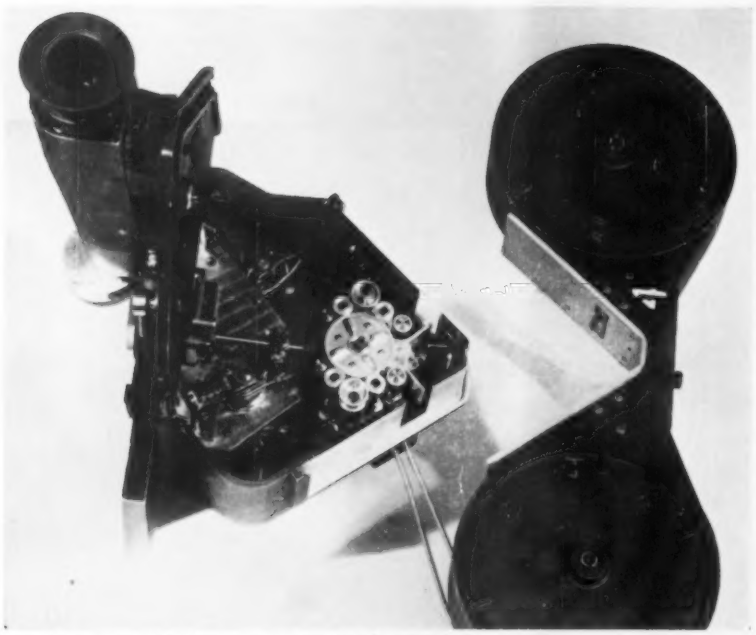


Fig. 2. Camera with door open; also a 400-ft magazine.

either side of the film in the first sprocket holes beyond the frame line in the direction of the film pulldown mechanism. The steadiness of the picture is excellent. As seen in Fig. 2, the opening of the top door permits ready access to the movement. Only one sprocket wheel is employed for both feed and take-up. The stripper-buckle switch assembly also operates on both feed and take-up at the same time. It is so sensitive that it will trip and stop the motor when the end of the roll of film comes through, stopping the film before the end reaches the aperture plate and thereby preventing possible damage to the registration pins. A reset button is mounted on the back of the camera between the magazines.

An important feature of this design is the fact that by removing only three screws, the movement and its attached drive motor can be pulled out of the camera case and operated in the hand of the operator (Fig. 3). This permits quick inspection of the gearing, shutter or movement in case of trouble. Removal, complete servicing and replacement of the movement in the camera case can easily be done in 15 to 20 min—an important asset in case of trouble in planes, boats or other difficult locations.

Lightweight Housing: In order to reduce the weight to a minimum, the housings of the camera and the magazines have been made of cast magnesium. Adequate strength is retained, however, to withstand the rigors of rough handling.

Magazines: The 400-ft magazine is shown in Fig. 2. It weighs less than 4 lb empty and just under 6 lb when loaded with film. A 1000-ft magazine of the same design is also available. The magazine is belt driven from the film sprocket driveshaft and the belt pulley has a cover plate to prevent clothing of the operator from getting caught. Free running upper and lower flanges are provided — an asset when the camera is turned on its side or upside down during maneuvers. Two latches, one on either side of the camera case, lock the magazine in place (Fig. 4). The top door of the camera extends over the top of the magazine to aid in holding it in place.

Threading is easily accomplished due

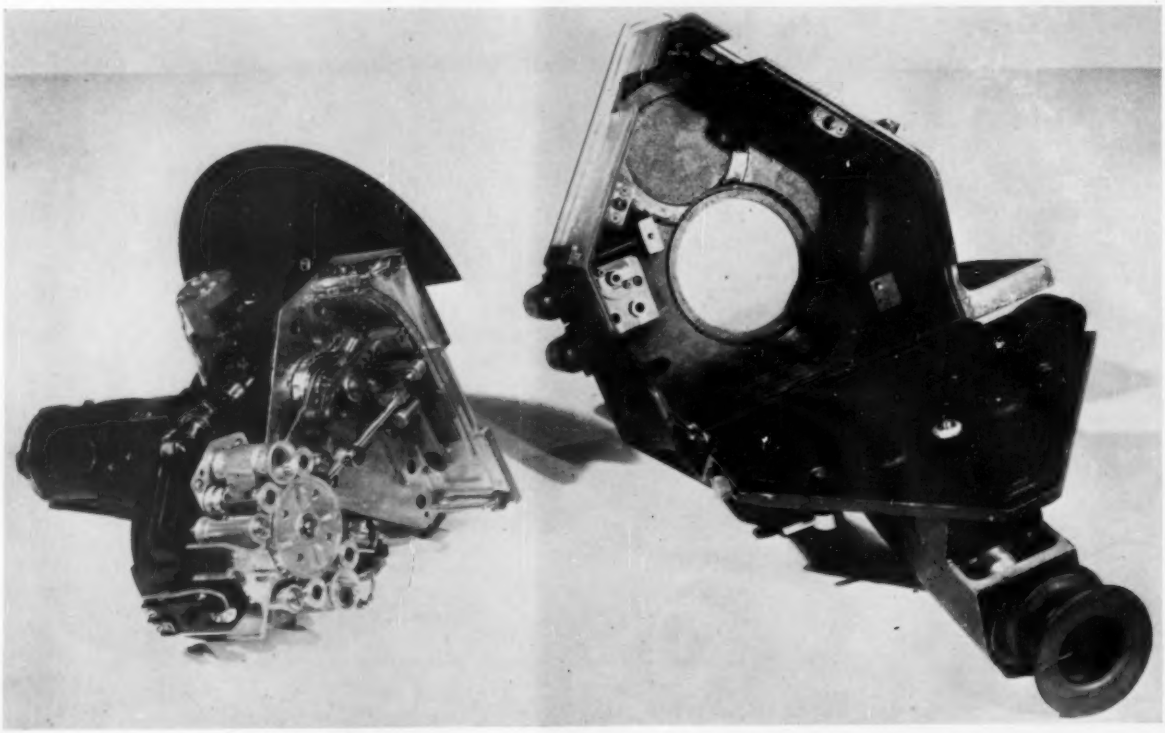


Fig. 3 Operating mechanism removed from case.

to the open construction of the movement area. A 3-digit footage numbering counter is mounted at the left side of the finder tube.

Lenses, Shutter and Finder: Lenses are attached to the camera with a positive locking screw thread latch and a modified Leica mount. The lenses, which can be easily changed, are normally supplied in focal lengths of 28, 35, 50, 85 and 152 mm. If needed, 40 mm and 100 mm and a special 20mm lens are available. Manual focusing is used. Sun shades, matte boxes, polarizing filter mounts, etc., are provided and used as needed.

The finder axis is $2\frac{1}{2}$ in. directly above the axis of the camera lens. Manual adjustment for parallax is provided. A separate finder lens matches the field of the respective camera lens with essentially the same size matte for each lens.

The shutter is of the fixed type and is fully open for $162\frac{1}{2}°$ and has an effective opening of 170°.

Motor System: For normal 28-v service, a lightweight governor controlled d-c motor is provided. This motor weighs 1 lb 14 oz and draws 2.6 amp at 4500 rpm at 0°F when pulling film at the normal 24 frames/sec. Speed control from 12 to 24 frames/sec is obtained by control of the supply voltage. A precision electric tachometer, $1\frac{1}{2}$ in. in diameter, is mounted on top of the camera. It is calibrated from 12 to 24 frames/sec., and is operated by a $7\frac{1}{2}$-v., 3-oz generator which is driven directly by the shutter shaft. It should be noted that the assistant cameraman can remove the tachometer and hold it in his hand if that is more convenient for remote speed control while running. The motor switch is mounted on the motor.

For completely self-contained operation, the operator can wear a 30-v battery belt weighing $18\frac{1}{2}$ lb which includes the speed control rheostat, non-spillable storage battery cells and cable. This battery has sufficient capacity for 5 hr of continuous operation. The wiring provides for automatic disconnect of the 24-frames/sec governor in case underspeed operation is desired.

Other motor-drive systems are also available. A 96-v multiduty motor is provided for synchronous sound recording. A 96-v series compound-type motor is also used when 96 to 115 v a-c or d-c supply voltages are available. It has the same torque as the 28-v motor described above.

Noise: The noise level of the camera is very low and entirely adequate for outdoor use. The reduction in noise is due to the use of phenolic gears, reduced loop slap, a curved case to reduce resonance, and the elimination of the multiple stages of gearing found in many other camera designs.

Gear Head and Tripod Use: The camera can be attached to all standard tripods, gear heads, etc. A new type of very lightweight friction head is also in design, which tilts approximately at the nodal point.

Conclusion

Wide-screen presentation of pictures in theaters has required the use of larger negatives in cameras. The double-frame camera described in this paper now makes it possible to obtain the same high quality of photography on location, using lightweight equipment, as is obtained in the studio. The credit for the design of this revolutionary camera goes to the Technical Departments of Paramount Pictures Corp.

Discussion

Herbert Lowen (Zoomar): What is the exact flange focal distance and the free back focal length required for the camera? I mean the distance between the last lens element and the film.

Mr. Ryder: I cannot give you those figures in absolute amounts but they are the same as the distance in a Leica-type camera and we use Leica-type lenses.

Henry Roger (Rolab Laboratories): In the case of a commutator switch which is mounted on a wild motor for the purpose of synchronizing sound, suppose the wild motor runs a little slower or a little faster, would there be an appreciable wow as the result; for example, if you make a test on a sustained note? Is this device similar to one designed by Col. Ranger for synchronizing a $\frac{1}{4}$-in. tape?

Mr. Ryder: I'm not familiar with the work of Col. Ranger you cite with respect to taking the control frequency from a d-c motor and carrying it to a recorder nor of work in conjunction with any vibration of sound taken for recording. With respect to the steadiness of such a recording, it would be my opinion that such a recording would not be good for music. If you maintained synchronization with the camera in the sound print that was made from the master magnetic, it would not be satisfactory for usage. But as far as the voice is concerned, my experience indicates that you are not conscious of it, because in the printing machine, or I should say the magnetic transfer machine from which you obtain the daily, it is impossible to change speed fast enough to get you into that type of trouble. And even though it may lag or lead at times, the amount of lag or lead is in the order of a sprocket hole or two, which causes no trouble. But such a system does have the disadvantage that if the cameraman lets the camera drop in speed to 23 frames, or if he lets it go over speed to 25 frames, you can begin to notice a difference in the pitch of the voice. I see no reason, with modern control devices, for letting the camera drift that far. We believe that we can keep it within that range.

But I'll go one step farther to say that in my experience and in work at Ryder Sound Services we handle quite a bit of independent recording where somewhat wild shooting is done. We are returning to those customers a daily which follows and synchronizes with the picture. It may be off-beat a little bit. If they have let their camera drift and the recorder drift off speed far enough to make it objectionable, we just give them another daily which is returned at exactly the same speed as the original recording. I refer to particular scenes, and I've had only two or three such scenes in a number of pictures. In those scenes it is merely necessary for the cutter to take the constant speed sounds and keep shifting them a slight amount matching a positive speed and put them in synchronization. He is not confronted with the usual problem that exists of resynchronizing sound to picture when he has no guide to do it by.

Fig. 4. Top view of camera.

Thomas T. Goldsmith, Jr. (Du Mont Laboratories): You have a 400-ft magazine on this handheld machine. Am I right that VistaVision being a double-frame system would allow it to run about two minutes a take?

Mr. Ryder: That is correct.

Dr. Goldsmith: But the possibility of this mechanism that you now have being a more adaptable mechanism with a different film magazine — is this a superior mechanism assembly even if you did have a different magazine than the one that you've been using.

Mr. Ryder: Although it is not in use, we do have a larger magazine assembly in construction. It will hold 1,000 ft of film and is carried by the camera mount and not directly on the camera.

Dr. Goldsmith: Is there any thought of producing this camera for any other process than the double-frame horizontal VistaVision, maybe even the conventional vertical type?

Mr. Ryder: We at Paramount are primarily interested in our own problem. The work that goes through our shop is meant to meet our own specific requirements. We're happy to make any of these thoughts available to anybody who wants to take advantage of them. If some of these ideas may be applied to cameras of the vertical type we are happy to see them applied. But we at Paramount are not contemplating any change from the system of shooting now being used by Paramount.

George Lewin (Signal Corps. Pictorial Center): Is the recorder to be used with this camera a sprocket-type recorder?

Mr. Ryder: It is a sprocket-type magnetic recorder but the sprockets are of no consequence.

Mr. Lewin: Do you care to disclose the method you use for synchronizing?

Mr. Ryder: I shall be happy to completely disclose the method of synchronization as soon as it is worked out and in complete operation. I shall present a paper at a future convention.

I was certainly intrigued by what took place in the shooting of our picture *The Mountain* in the Swiss Alps. Our lightweight sound channel was carried by three men, which seemed like quite an accomplishment, but the new camera was carried by one man. We at Paramount will not be happy until we have a sound channel that can also be carried by one man.

The Pyral Striping Machine

By LOUIS MARTIN

This paper deals with the striping process which has been applied since 1950 to substandard film and since 1953 to CinemaScope film. A shoe is used, with striping orifices through which constant width stripes are deposited, their thickness resulting from the angle at which the film leaves the shoe. All such orifices are on the same shoe, ensuring, particularly for CinemaScope striping, a positively fixed distance between the centerlines of the stripes.

THE FIRST commercial striping service in Europe, and possibly in the world, was started in France in the year 1950, when the S.C.I. Pathé, having equipped its 9.5mm motion-picture projectors for magnetic recording and reproduction, entered into a lease agreement with Pyral, for the striping of its 9.5mm wide film, with sprocket holes in the center, and a magnetic stripe on one edge.

When the RCA model 400 16mm magnetic projector made its appearance in the United States in the fall of 1951, Pyral had already built a striping machine for this standard. When other makers produced their 16mm magnetic projectors, Pyral had developed a worldwide network of licensees, so that facilities were available for the amateurs or semiprofessionals who were the first buyers of this type of magnetic projector.

The advisability of adding a "balance" track outside the sprocket holes on 16mm film with one row of perforations was recognized from the start by Pyral, and also the necessity of equipping the striping machines with an optical device to control the lateral position of the magnetic track, when it was made half-width, so that the critical edge of it would coincide with the center of the photographic track, in the case of a symmetrical area track.

Magnetic striping was also applied by Pyral to 8mm film. The same machine was used for the different substandard sizes, the changeover being made easier by the fact that a sprocketless film drive had been deliberately chosen from the start.

At the advent of CinemaScope, the type of striping machine which had been developed for substandard film was adapted to 35 mm 4-track striping. In the year 1955, more than 32 million feet of prints was striped according to the CinemaScope standard, in England, France and Italy. During the same year and also using Pyral machines, more than three million feet of substandard film, chiefly 16mm, was striped.

Description

Let us examine the basic ideas that led to the development of the machine: a single hopper is used with the appropriate number and location of vents, consisting of holes in the cylindrical surface which constitutes the shoe at the bottom part of the hopper. The film runs against this surface, and receives the coating mixture which flows by gravity through the vents. This disposition ensures a width of the stripes on which film speed as well as mixture viscosity have minimum influence. As far as the thickness of the stripes is concerned, it is controlled by altering the position of a roller on which the film passes after leaving the shoe, thereby varying the position of the generatrix along which the film leaves the cylindrical surface of the shoe.

Figure 1 shows the striping mechanism of a 16mm machine. After leaving the upper flange and passing over rollers and a tension arm, the film is held back by a friction drive. It then reaches the hopper, under which a scale can be seen. The position of the adjustable roller which controls the thickness of the stripes is indicated by a needle on this scale. The driving friction can be seen at the left of the photograph.

Controls

The use of a single hopper with all the stripe outlets in a row ensures an accurate distance between the centerlines of the stripes. For example, in the case of a 4-track CinemaScope standard the relative position of the tracks is obtained automatically and their proper lateral location can easily be adjusted by making the two margins equal on both film edges. The optical device shown in Figs. 1 and 2 serves this purpose.

The cylindrical shape of the shoe has the advantage of giving the film surface a radius of curvature in the same order of magnitude and in the same direction during the striping operation as it will have in the recording and reproducing processes. Therefore, it can reasonably be expected that even if a print is not ideally flat, defects will be minimized.

Because the film is tensioned around the shoe, no support is needed for it and variations in film thickness, or splices, have no effect on the thickness of the stripe.

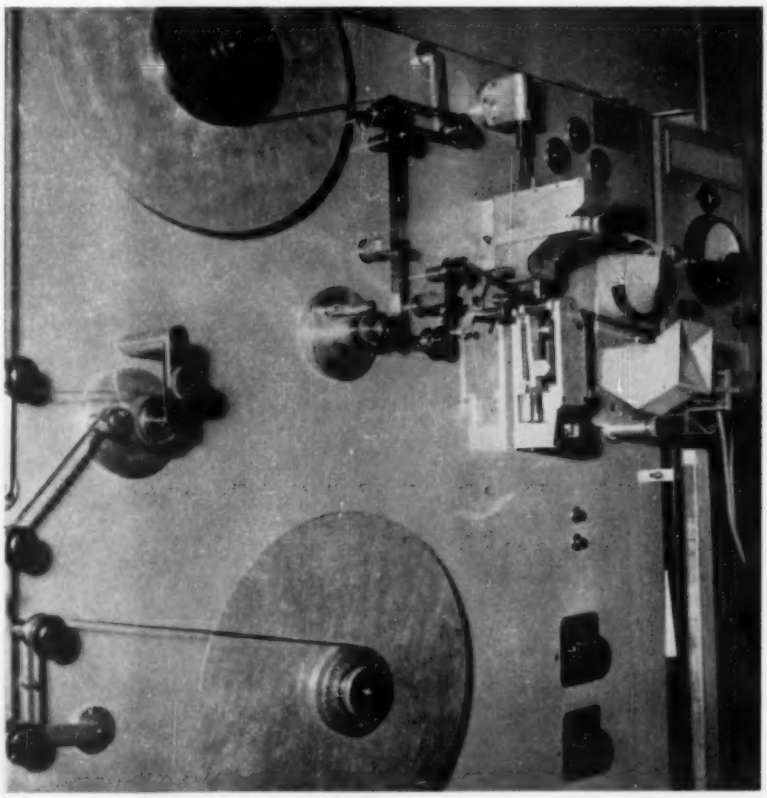


Fig. 1. Pyral striping machine for 16mm film.

A contribution submitted on April 5, 1956, by Louis Martin, Consulting Engineer, Pyral, 47 Rue de L'Echat, Créteil (Seine), France.

Figure 2 (same 16mm machine as shown in Fig. 1) shows that the coated film after passing through the viewer is directed through another device. This performs the checking of stripe thickness: it compares the reluctance of the stripe (a function of its thickness) to the reluctance of a calibration stripe.

The frequency of the oscillator used for the purpose is in the order of the normally used bias frequencies.

In the case of multitrack striping, each stripe can be tested independently by means of a meter. If only one useful track is striped, it is compared with the standard track by means of a sound control device through which beats are heard until, by varying the position of the roller located after the hopper, the same thickness is obtained as that of the calibration stripe. The sound then disappears. It will, however, reappear as a warning signal to the operator if the thickness should change. The accuracy is about 1/50 of a mil.

The audio control is of particular use for 16mm film with one row of perforations, where the track which takes the place of the photographic track is the only one used. It is also of great help when striping photographic raw stock as it permits making adjustments in total darkness.

Whatever the type of film and the type and number of tracks, the initial thickness adjustment is made on the leader (a couple of feet of which are sufficient), after which the adjustment obtains for the whole length of the print.

Film elevators permit a continuous operation from the machines (16mm as well as 35mm).

The normal striping speed of the 35mm machines is 25 frames/sec for a 50-cycle supply; it would be 30 for a 60-cycle supply. This speed can be boosted to 50 or 60 frames on the 16mm machines. A stroboscopic check of the constancy of film motion is thus easy to achieve. Figure 3 shows a 35mm CinemaScope striping machine, complete with the coating mixture feeding circuit, the film elevators at the back, and the stripe thickness control.

Acknowledgment

The author wishes to express his thanks to the designer of the machine, A. B. Saint-Hilaire, Technical Manager of Pyral, for his help and advice in the preparation of this paper.

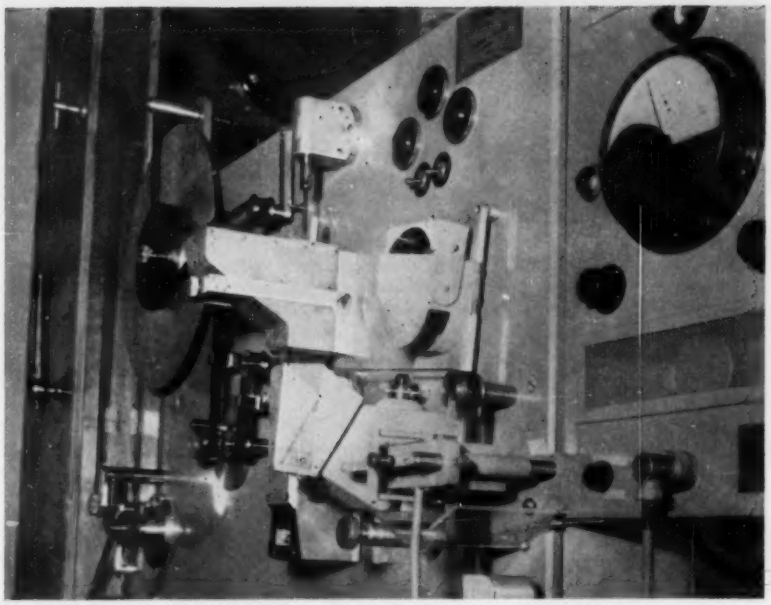


Fig. 2. The 16mm machine, showing the stripe-thickness control device.

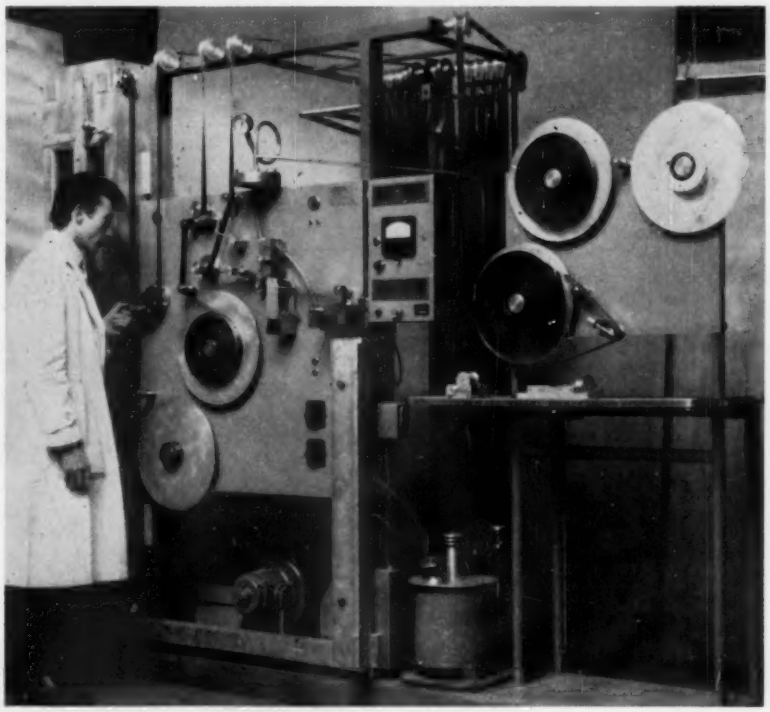


Fig. 3. Pyral striping machine for 35mm CinemaScope film.

Color TV Commercials by Use of Direct Artwork With Opaques

By PHILLIP B. LAESER

Presenting and transmitting a color commercial during the station break seemed at first no problem because there were available 35mm slides, color film and the live color camera. However, experience during some 400 color programs transmitted through this station — several hundred hours originating from NBC network and the balance originating in this station's own studios — showed that none of these methods of handling the station break was entirely satisfactory. The solution to this problem for WTMJ-TV was found in its new Colorbal unit.

It has been realized for some time that an opaque pickup unit for artwork was badly needed in our TV broadcasting station when transmitting color. The only possible way that a station could televise color artwork was by using this material placed on an easel in the studio, before the live camera. Opaques, such as title cards, news photographs and spot advertising announcements, have been used at WTMJ-TV for the past 8 years in our monochrome operations. A local sponsor could use the color system during the station ID period by transferring his message to a 2 × 2 color slide transparency or by putting it on 16mm film. Obviously many sponsors objected to the cost and the many delays since very few took advantage of the station ID periods, preceding, during or after local or network programs which were televised in color.

Transmitting numerous groups of 2 × 2 color transparencies on a 3-vidicon or a flying-spot scanner system during the past several years revealed difficulties and objections caused by the wide ranges of film densities. Sudden density changes from slide to slide produce extremely wide fluctuations in the video signal. Only a few commercial color films or 35mm transparencies have been used preceding, during or after the local color programs or network color programs. After concluding that it was desirable to use color for the station break announcements, and that the solution was to use direct artwork with opaques, we began to develop the system.

The first requirement, of course, was a suitable opaque projection unit. During 1954 and early 1955 manufacturers were not producing a suitable unit for this use. One manufacturer would have built for our station a projection unit to work into the 3-V color-film multiplexer, but only marginal results were promised. A considerable proportion of material would have to be rejected because of insufficient light. It was anticipated that an unsatisfactory signal-to-noise ratio would prevail on the rejected material. Obviously under these doubtful performance conditions, this station could not undertake that particular investment. A further disadvantage of such a proposed projector was that the color art material could be no larger than $3 \times 4\frac{1}{4}$ in.

Art material considerably larger than $3 \times 4\frac{1}{4}$ in. has been recommended by the WTMJ-TV art department. At present this station has a monochrome opaque projector which uses art material of $5 \times 6\frac{3}{4}$ in. This is considered about the minimum size which would produce acceptable results. The art department also suggested that the use of color would require an increased working area. For example, hand-lettered material of 3 × 4 in. size blown up six or eight times through the television system shows many flaws. Consequently, it was expedient to build a new color opaque projection unit. After experimental tests, $7\frac{1}{2} \times 10$ in. proved to be an acceptable size on which additional tests could be made for a new color unit. This size represents about a 100% increase in the overall area, allowing the artist much more freedom in the freehand preparation of his work. Advertising agencies generally have available quantities of material such as cardboard store posters, copies of newly run magazine ads and newspaper runs of paper color which are suited for this proposed size.

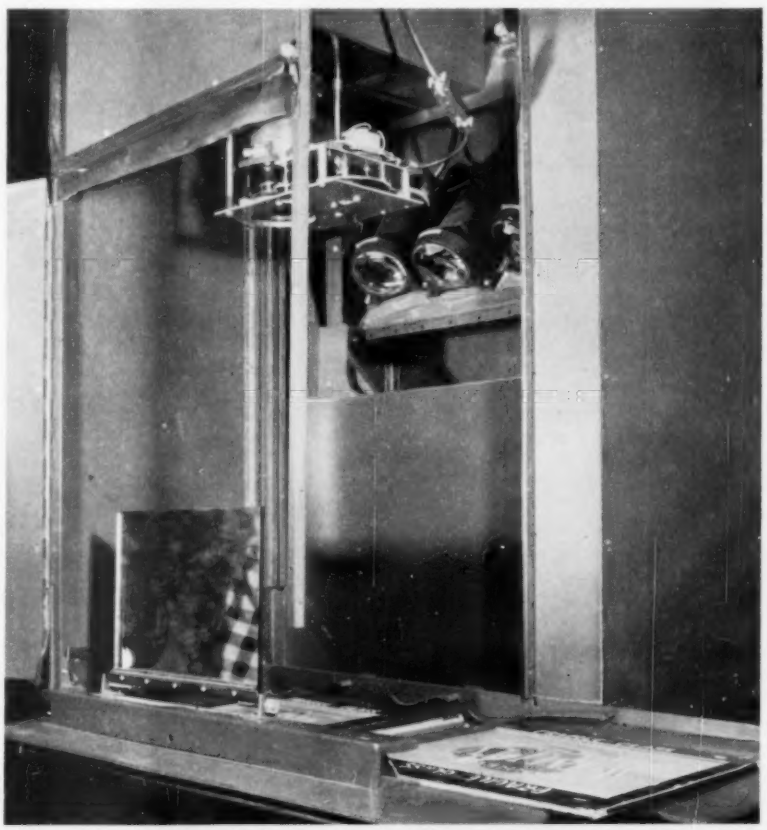


Fig. 1. Colorbal Opaque Projection Unit. A flying-spot scanner system, shown with baffle, provides the light source. A front-surface mirror stands vertically at the left of the artwork bed. The light shield was removed for this photograph.

Presented on October 6, 1955, at the Society's Convention at Lake Placid, N.Y., by Phillip B. Laeser, Radio and TV Engineering, WTMJ, The Journal Co., Milwaukee 1, Wis.
(This paper was received on November 14, 1955.)

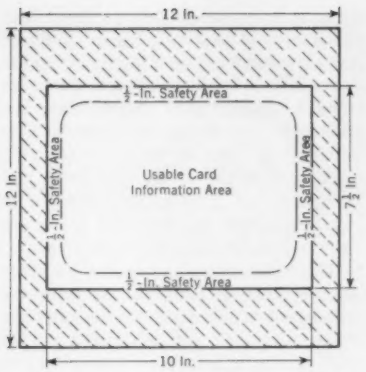


Fig. 2. Colorbal card, simply a 12 × 12-in. card, about 3/16 in. thick, with adjustable information area.

During 1955, this station built several experimental types of opaque projectors (Fig. 1). The WTMJ-TV Colorbal unit is so named, in part, as a shortened form of "balopticon," "balop," of course, being the usual term automatically used in the trade. The Colorbal unit, as finally devised, takes on an overall characteristic of a photographic enlarger such as one would have in a darkroom. The light source provided is from the flying-spot scanner system. The 12 × 12 in. "balop" cards (Fig. 2) are inserted into the horizontal scanning area directly underneath the light source. At the same time, this card pushes the preceding scanned card out of the electronic viewing area. A switch is used to douse the kinescope light source so that no picture is transmitted while the card is being moved.

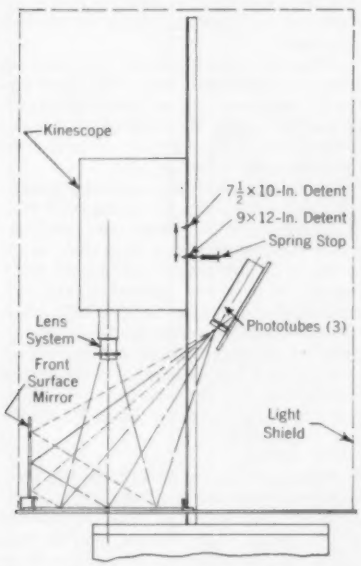


Fig. 5. Schematic drawing of the flying-spot light source, the lens system, the artwork bed, front surface mirror and photoelectric cells. Note also that the light shield is indicated on the diagram. Only two of the four detents making it possible to vary the size of the artwork are indicated on the diagram.

Fig. 3. Artwork in several sizes is examined by the author and Ed Stenzel of the staff. For this photograph, the light shield was removed, and the baffle and mirror do not appear here. The flying-spot scanner is shown lowered almost to projection position.

The flying spot has proved to be very stable and requires very little attention compared to a live color camera or to the film unit. Registration is no problem. The pickup unit uses three photoelectric cells which are relatively economical compared with image-orthicon or vidicon tubes. The entire unit can be readied for operation in considerably less time than live or film equipment. Several demonstrations have been made within five minutes from a cold start. The initial Colorbal unit was devised as a single-stage unit. Presently under construction is a dual unit allowing alternate sets of art material to be transmitted. This eliminates the brief time gap (about $\frac{1}{5}$ sec) which now occurs when the artwork slides past the flying spot.

Some details of the new unit will bear description. The deflection yoke and kinescope along with its housing were removed from the previous table-top position and mounted vertically on a new angle-iron frame. The face of the kinescope tube now points downward toward the base assembly. The old lens system, slide-changing mechanism and dichroic mirror assembly were discarded and replaced by a new $6\frac{1}{4}$ in. $f/2.5$ lens. A remote iris control was added to the new lens system in order to obtain extremely smooth video level adjustments. The high voltage and deflection amplifiers were left in their original positions in the rack cabinets below. With this arrangement sufficient light for various raster sizes was obtained from the lens system at various heights. Adequate signal-to-noise ratios are maintained for the following size cards:

Fig. 4. Artwork in several sizes shown in place. For this photograph, the light shield is removed. The mirror and the remote control gain mechanism can be seen at the top of the photograph. Note the two sizes of station identification cards also shown in the photograph. The hand in the picture is pointing to the cutoff switch for blanking the screen for one-fifth of a second during the card change.

Raster size, in.	*Lens distance to art material, in.*
9 × 12	27
7¼ × 10	23
5 × 6⅔	17
3 × 4⅓	13

See Fig. 3 for Colorbal cards.

This new flying-spot assembly was constructed to ride up and down along a guide rail mounted on either side of the unit. The weight of the light-source unit was counterbalanced with a lead counterweight so that it moved freely and easily by hand. Spring-loaded detents are used to regulate the desired or proper height for any specific artwork. The three photocell assemblies were remounted horizontally on a slotted panel directly behind the flying-spot mechanism. Each unit is so constructed that it can be mechanically shifted in various directions. This requirement was revealed when later adjustments on video shading became necessary. A flat field as checked by the cathode-ray presentation at the video console for each of the red, blue and green channels thereby is assured.

Directly above and to the rear of the phototubes are their corresponding preamplifier assemblies. The power and video output circuits from these amplifiers were extended to the gamma and channel amplifier units below, and the

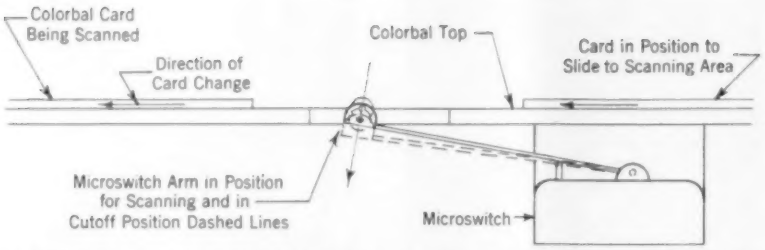


Fig. 6. Diagram of the artwork bed showing the microswitch action. This switch action cuts the kinescope one-fifth of a second, allowing the card to be changed during this blanked-out period.

entire flying-spot unit is enclosed in a suitable housing to prevent the incandescent room light from falling on the artwork channel. As shown in Fig. 4, a front-surface mirror is placed vertically in front and at the side of the artwork position. A considerable improvement is thereby gained in the light-collecting efficiency of the photoelectric cells. As measured on the cathode-ray oscilloscope at the video console, an estimated gain of 40% in the output is achieved at no loss of resolution. The unit can be lined up by using four 12 × 12 cards. For our use, one card was covered with red "Color Aid" paper, one with blue and one with green. Each of the colors is of the pure hue. Each channel is then adjusted so that there is a minimum of impurity as noted on a color monitor. A white card is finally used as reference check mainly to set maximum video levels. The artwork bed (Fig. 5) in which the various cards are slid is equipped with a microswitch which is actuated when a new card is being moved into the operating position. Figure 6 shows how this switch is placed in relation to the cards. The switch is inserted in the beam current supply and extinguishes the kinescope tube during this interval. The entire video amplifier section is lined up electrically as previously used for 2 × 2 transparencies. This includes the use of the colorplexer as does the live color camera and the film projection unit.

The results from using the Colorbal are the best so far obtained from the standpoint of television viewers, and the compact unit is conveniently and quickly used during a broadcast. Either colored or black-and-white art material may be transmitted interchangeably. An important advantage of the system is that the artwork can be directly presented in color without the time and expense of having a color slide made.

The Colorbal unit has been moved into the master control room at WTMJ-TV. It is used daily to transmit station breaks in black-and-white or in color, as the program calls for, and is scarcely more effort than the station break itself.

motion-picture standards

Revision of 16mm Photographic Sound Record Standard

Proposed revision of the American Standard on **Photographic Sound Record on 16mm Prints, Z22.41-1946,** now referred to as PH22.41, is published here for a three-month period of trial and criticism.

Review of this standard was initiated in January 1951. The sole question at that time was whether the guided edge specification was consistent with other 16mm film standards. This question was put to the Laboratory Practice, 16 & 8mm and Sound Committees since all three have an interest in this standard. A wide diversity of opinion was found to exist, and several years of intermittent study, discussion and debate elapsed before a decision was reached to retain unchanged the guiding specification on the soundtrack edge. This position was supported by Messrs. Lyman and Chandler in a detailed study entitled "Recommendations for the Edge Guiding and Registration of 16mm Film," SMPTE 735B. This report, available from Henry Kogel, indicated that further study was required before a specific recommendation could be made to change the present standard.

Once undertaken, the review was not confined to the edge guiding question. The following revisions were proposed and found ready acceptance:

1. The title has been shortened and the term "photographic" added, made necessary by the rapid development and use of magnetic sound.

2. The form has been altered to include a limiting scope, formal specifications, a table of dimensions and a simplified diagram.

3. A picture-sound separation specification has been added.

4. A caption relating the specified dimensions to unshrunk raw stock has been deleted. This was done because the shrinkage factor is an irrelevant variable which does not affect the placement of the sound record on the film.

In March 1954, a new question was raised respecting the need for retention of the nonsymmetrical tolerance on the width of the variable-area record, dimension C. However, the +6 −1 mil tolerance is continued rather than changing to the ±1 mil tolerance that had been suggested in the 1946 standard for use in future designs. The argument supporting retention of the nonsymmetrical tolerance was prepared by L. T. Sachtleben of RCA at the invitation of the 16 & 8mm Committee and accompanies the proposal.

All comments should be sent to Henry Kogel, SMPTE Staff Engineer, prior to July 15, 1956. If no adverse comments are received, this proposal will then be submitted to ASA Sectional Committee PH22 for further processing as an American Standard.—*H.K.*

The Story of RCA's Adherence to the 0.065-in. Wide Optically Reduced Variable-Area Soundtrack on 16mm Film

Originally the RCA optical reduction sound printer reduced the old 0.070-in. wide 35mm area track to 0.060 in. on 16mm film, and this met the 16mm printed track standard nicely in all respects, including the 0.080 in. to 0.085 in. width of exposed print area.

When the new 0.076-in. wide 35mm area track was introduced, the width of the optically reduced area track automatically increased to 0.065 in. By that time the original RCA white-light reduction printer had been designed, built and marketed.

The situation remained as described until the subject was taken up by the ASA War Standards Committee, some ten years later, when the standard was stretched, so to speak, to include tracks made by the RCA printer. A note was appended, and still remains on the Standard ASA Z22.41-1946, which recommends that all future equipment be designed, and all existing equipment be modified, to produce variable-area records "as close as practicable to 0.060 ± 0.001 in." The standard actually calls for $0.060\ ^{+0.006}_{-0.001}$ in.

RCA agreed to this note of recommendation when put into the "as close as practicable" form. RCA has never interpreted this to be an unconditional promise that RCA equipment would be made to meet the 0.060 ± 0.001 in. figure.

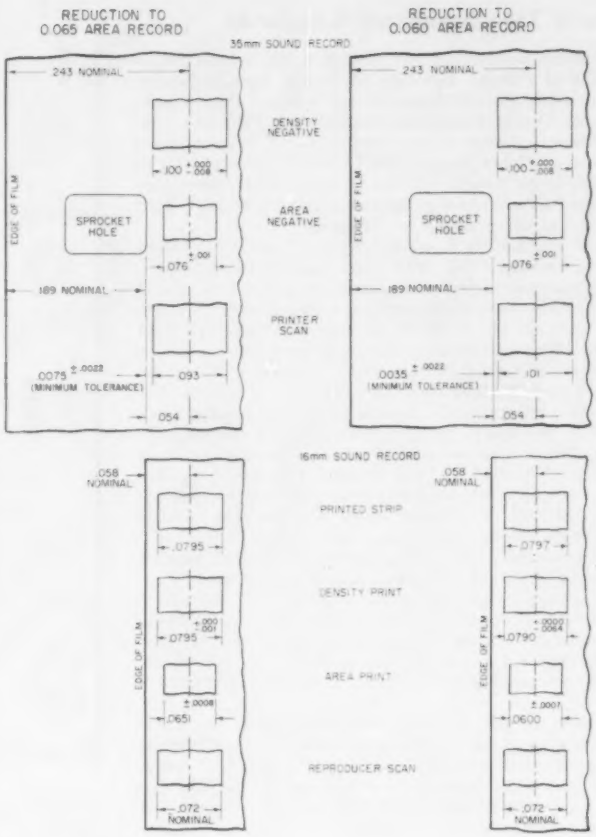
In late 1946 and early 1947, RCA diligently attempted to find a way to reduce the printed area track width to 0.060 ± 0.001 in., in accordance with the note of recommendation on the standard. The accompanying study diagrams made at that time show that to produce a printed width of 0.080 in. (the minimum under the

standard) and a variable-area track width of 0.060 in. from a 0.076-in. negative track, the printer light will have to scan within 0.0035 in. ± 0. 0.0022 in. of the 35mm sprocket holes; or possibly closer, since the ±0.0022-in. tolerance is a *minimum* tolerance.

Furthermore, it also works out that a reduction printer that makes the 0.060-in. printed area track from a 0.076-in. negative track will be in conflict with standard dimensions for full-width density tracks. This is because a 0.092-in. wide density negative (the minimum allowable by existing standards) will print by optical reduction to a width of 0.0726 in., which is about 0.006 in. under the minimum permitted by the standard for variable-density prints on 16mm film. When the reduction printer produces the 0.065-in. area track from the 0.076-in. area negative, however, it makes a 0.079-in. wide (lower limit) print of a 0.092-in. wide (lower limit) variable-density negative.

The reduction printer, if designed to produce the 0.060-in. area track, will not only have to scan unacceptably close to the sprocket holes of the negative, but will also produce a nonstandard density print from density negatives that are made within standard limits. The latter will be true for any printer magnification that produces an area track narrower than 0.065 in.

After very careful consideration it was decided on January 22, 1946 that the 0.065-in. dimension for the optically reduced area track presented the best compromise that could be made under existing standards, and was "as close as practicable to 0.060 ± 0.001 in.—*L. T. Sachtleben*



Proposed American Standard

Photographic Sound Record on 16mm Prints

PH22.41

Rev. Z22.41-1946

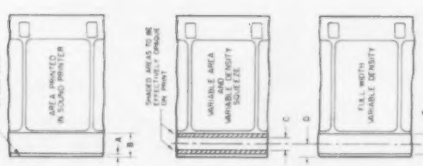
1. Scope

1.1 This standard specifies the location and dimensions of variable-area and variable-density sound records for the photographic printing of sound on 16mm motion-picture film perforated along one edge. Also specified is the area scanned in the sound reproducer.

2. Dimensions

2.1 The dimensions and location of the sound record shall be as specified in the diagram and table.

2.2 The sound record as printed on the film shall be displaced from the center of the corresponding picture by a distance of 26 frames ± 1/2 frame in the direction of film travel during normal projection.



NOTES

1. Where the original sound record has been reduction printed in some stage of the process, it may be impossible to obtain the black septum on either side of the record area. The presence of a clear septum between the sound and picture areas which does not encroach on the minimum tolerances of the printed area shall not be a basis for the rejection of prints. Shaded septum areas are intended to include all unused areas on both sides of the sound record, up to the picture on one side and up to the film edge on the other.

2. Dimension C is based on present-day equipment design. It is recommended that all future equipment be designed for a record width of 0.060 ± 0.001 in. and that existing equipment be modified to produce prints having dimension C as close as practicable to 0.060 ± 0.001 in.

Dimensions	Inches		Millimeters	
A	0.018	max.	0.46	max.
B	0.110	max.	2.79	max.
	0.098	min.	2.49	min.
C	0.060	+ 0.006 — 0.001	1.52	+ 0.15 — 0.03
D	0.058	± 0.002	1.47	± 0.05
E	0.080	± 0.001	2.03	± 0.03
F	0.058	± 0.001	1.47	± 0.03
G	0.072	max.	1.83	max.
	0.070	min.	1.78	min.

NOT APPROVED

Proposed American Standard

Projected Image Area of 8mm Motion-Picture Film

PH22.20

Rev. Z22.20-1950

1. Scope

1.1 This standard specifies for 8mm motion-picture projectors the image to be projected and the relative positions of the aperture producing this image, the edge guide and the film registration device.

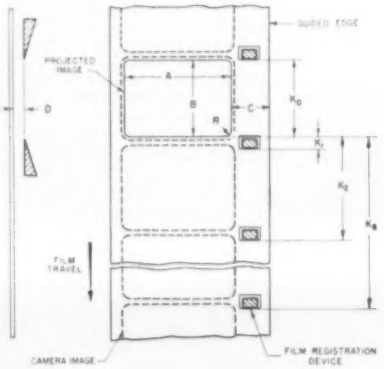
1.2 The notes are a part of this standard.

2. Dimensions

2.1 The dimensions shall be as specified in the diagram and table.

2.2 The angle between the vertical edges of the image and the edges of normally positioned film shall be $0° \pm ½°$.

2.3 The angle between the horizontal edges of the image and the edges of normally positioned film shall be $90° \pm ½°$.



DRAWING SHOWS ARRANGEMENT AS SEEN FROM INSIDE PROJECTOR LAMPHOUSE LOOKING TOWARD THE LENS

Dimensions	Inches	Millimeters
A	0.172 ± 0.001	4.37 ± 0.03
B	0.129 ± 0.001	3.28 ± 0.03
C	0.119 ± 0.002	3.02 ± 0.05
D		
K_0	0.114 ± 0.005	2.90 ± 0.13
K_1	0.035 ± 0.005	0.89 ± 0.13
K_2	0.184 ± 0.005	4.67 ± 0.13
K_3	0.333 ± 0.005	8.46 ± 0.13
K_4	0.482 ± 0.005	12.24 ± 0.13
K_5	0.631 ± 0.005	16.03 ± 0.13
K_6	0.780 ± 0.005	19.81 ± 0.13
K_7	0.929 ± 0.005	23.59 ± 0.13
K_8	1.078 ± 0.005	27.38 ± 0.13
R	0.010 max.	0.25 max.

NOT APPROVED

Revision of Two American Standards

Proposed revisions of American Standards **Z22.8-1950, Location and Size of Picture Aperture of 16-mm Motion-Picture Projectors** and **Z22.20-1950, Location and Size of Picture Aperture of 8-mm Motion-Picture Projectors,** are published here for a three-month period of trial and criticism. All comments should be sent to Henry Kogel, SMPTE Staff Engineer, prior to July 15, 1956. If no adverse comments are received, these proposals will then be submitted to ASA Sectional Committee PH22 for further processing as American Standards.

Revision of Z22.8-1950 was undertaken by the 16 & 8mm Committee in October 1954, and extensive modifications both in form and substance were made. Two major changes will be readily discerned: (1) The fixed guides have been shifted to the opposite edge of the film. (2) The C and K dimensions are specified from real physical edges instead of as heretofore from the centerlines through the optical axes of the projector. The basis for the latter change was simply to facilitate measuring these quantities. The argument for the former is much more complex and is based on an extensive study of edge guiding of 16mm film by Messrs. J. S. Chandler and D. F. Lyman prepared at the committee's request. (This report, SMPTE 735B, was submitted to the committee on July 7, 1954. It is expected that this report will be published in an early issue of the *Journal*. However, those who wish to see this report sooner may have a copy upon request.)

The 1950 standard was hazy on one point in that it did not clearly indicate whether the given dimensions specified the physical aperture or the actual image area to be projected. This distinction is necessary because the two are not exactly alike, the difference being a function of the distance between the aperture and the film. The present proposal eliminates this confusion by consistently specifying the projected image. This change is reflected in the new title.

In addition to the above, there is an improved diagram, a new format with a scope and numbered specifications, and an appendix providing a preferred location for the vertical registration perforation.

The same comments apply to the revision of Z22.20-1950 with but one exception—no recommendation is made for locating the vertical registration perforation.—*H.K.*

NOTES

1. Dimensions A, B and R apply to the portion of the image on the film that is to be projected; the actual opening in the aperture plate has to be slightly smaller. The exact amount of this difference depends on the lens used and on the separation (dimension D) of the emulsion and the physical aperture. To minimize the difference in size and make the image of the aperture as sharp as practicable on the screen, D should be no larger than is necessary to preclude scratching of the film. When the reduction in size from the image to the actual aperture is being computed, it is suggested a 1-inch f/1.6 lens be assumed unless there is reason for doing otherwise.

2. The limiting aperture is shown as being between the film and the light source so that it will give the maximum protection from heat. If other factors are more important, it may be on the other side of the film.

3. In 8mm projectors the edge guide should bear on the edge of the film adjacent to the perforations. The other edge of the film usually is slit after processing and so is more likely to weave laterally with respect to the pictures.

The value of dimension C has been chosen so that film having a slight shrinkage when it is projected will be properly centered. This is the normal condition.

4. The K dimensions are measured along the path of the film from the bottom of the aperture to the stopping position of the registration device. It is customary to provide a framing movement of approximately 0.025 inch above and below this nominal position. For any given projector, use the value of K corresponding to the location of the registration device.

If the film does not stop exactly where the film registration device leaves it, because of coasting or some other cause, a slight adjustment of the value of K will be necessary.

NOT APPROVED

Proposed American Standard

Projected Image Area of 16mm Motion-Picture Film

PH22.8

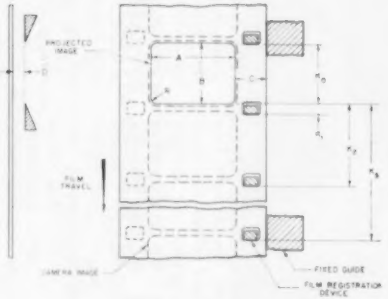
Rev. Z22.8-1950

1. Scope

1.1 This standard specifies for 16mm motion-picture projectors, employing 16mm film perforated along either one or both edges, the image to be projected and the relative positions of the aperture producing this image, the edge guide and the film registration device.

1.2 The diagram illustrates film with perforations along both edges. When single perforated film is used, the perforations appear only on that edge of the film that bears against the fixed guides.

1.3 The notes are a part of this standard.



DRAWING SHOWS ARRANGEMENT AS SEEN FROM INSIDE PROJECTOR LAMPHOUSE LOOKING TOWARD THE LENS

2. Dimensions

2.1 The dimensions shall be as specified in the diagram and table.

2.2 The angle between the vertical edges of the image and the edges of normally positioned film shall be $0° \pm ½°$.

2.3 The angle between the horizontal edges of the image and the edges of normally positioned film shall be $90° \pm ½°$.

Dimensions	Inches	Millimeters
A	0.380 ± 0.002	9.65 ± 0.05
B	0.284 ± 0.002	7.21 ± 0.05
C	0.124 ± 0.002	3.15 ± 0.05
D		
K_0	0.266 ± 0.005	6.76 ± 0.13
K_1	0.032 ± 0.005	0.81 ± 0.13
K_2	0.330 ± 0.005	8.38 ± 0.13
K_3	0.628 ± 0.005	15.95 ± 0.13
K_4	0.926 ± 0.005	23.52 ± 0.13
K_5	1.224 ± 0.005	31.09 ± 0.13
R	0.020 max.	0.51 max.

NOT APPROVED

NOTES

1. Dimensions A, B and R apply to the portion of the image on the film that is to be projected; the actual opening in the aperture plate has to be slightly smaller. The exact amount of this difference depends on the lens used and on the separation (dimension D) of the emulsion and the physical aperture. To minimize the difference in size and make the image of the aperture as sharp as practicable on the screen, D should be no larger than is necessary to preclude scratching of the film. When the reduction in size from the image to the actual aperture is being computed, it is suggested a 2-in. f/1.6 lens be assumed unless there is reason for doing otherwise.

2. The limiting aperture is shown as being between the film and the light source so that it will give the maximum protection from heat. If other factors are more important, it may be on the other side of the film.

3. The K dimensions are measured along the path of the film from the bottom of the aperture to the stopping position of the registration device. It is customary to provide a framing movement of 0.025 in. above and below this nominal position. For any given projector, use the value of K corresponding to the location of the registration device.

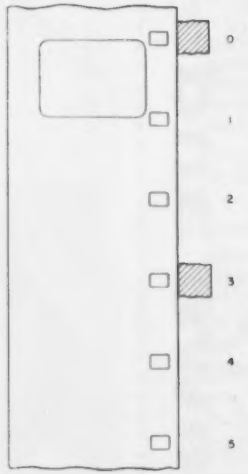
If the film does not stop exactly where the film registration device leaves it, because of coasting or some other cause, a slight adjustment of the value of K will be necessary.

APPENDIX

(This appendix is not a part of the standard.)

Perforation 3 in the diagram is suggested as the preferred location for vertical registration, being the perforation used in the numerically largest group of 16mm cameras. Individual design considerations may lead to the use of another perforation in any specific design.

If perforation 3 is used for vertical registration, good kinematic design points to the location of the edge guiding means at the points shown, opposite perforations 0 and 3.



NOT APPROVED

news and reports

Boyce Nemec, after ten years of service to the Society, has resigned as Executive Secretary, effective June 15. At that time he will establish a management consulting service specializing in problems of corporate structure, cost analysis, market studies, and the like, in the motion-picture and television industries.

Boyce's tenure at Society Headquarters has been a long and fruitful one. When he came to the job, the Society's most recent period of active growth lay back in the time of the technological upheavals of the late twenties and early thirties. The industry and the Society then made steady but slow advances until war and the coming shadow of television set off the chain of agonizing reappraisals that put the industry's engineers back in the spotlight. Almost as soon as Boyce took over his desk, there began a wave of unprecedented activity and growth, bringing the membership from 2300 in 1946 to the 5600 members, scattered in 55 countries of the world, that the Society has today.

But while the ferment was there, the growth was not automatic. The increasing furore in the industry meant rather an increasing challenge to the Executive Secretary in the exercise of tact and judgment, and the planning and supervision of enlarged and improved services for the rapidly growing membership. The era represented a great opportunity, and it was the Society's good fortune that Boyce was there to seize it.

Boyce studied electrical engineering at the University of Minnesota. At an even earlier age he had enjoyed tinkering with motion-picture projectors, and he worked for a time in the Department of Visual Education at the University of Minnesota. When the war came, he found himself, naturally enough, in the Signal Corps, and proceeded to spend a very energetic five years in the Army's motion-picture business. It was at this time that he came to know so many of those distinguished Signal Corps men who have continued to make names for themselves in the industry. As assistant to L. T. Goldsmith, Director of the Army's Pictorial Engineering and Research Laboratory, he was instrumental in forming the War Committee on Photography; served as secretary of the Interim Armed Forces Committee on Photography in its initial stages; and represented the Signal Corps' engineering and procurement interests on the War Committee, Federal Specifications Committee and Joint Army-Navy Specifications Board as chief of the Signal Corps' Photographic Specifications Unit.

Boyce joined the Society's staff in 1946 as Staff Engineer. An energetic hand was needed to organize and coordinate the Society's efforts for standardization in the industry, translating wartime standards into civilian form. By 1947, when he was appointed Executive Secretary, he had this department of the Society's work, involving the activities of the many engineering committees and their relationships to outside organizations such as the American Standards Association, sufficiently well trimmed away for the years to come.

Since he took over at Headquarters, Boyce has earned the friendship and respect of the entire industry for his administrative ability, initiative and success in coping with the many problems of the Society in a period of expansion. In appreciation of his contributions to the Society, Dr. Frayne, on behalf of the Board of Governors, presented Boyce with a citation at the 79th Convention banquet at the New York Statler on Thursday evening, May 3. Signed by the President and the Secretary, the citation read:

"*The Board of Governors of the SMPTE unanimously commends Boyce Nemec, whose foresight, initiative, and complete devotion to duty as Executive Secretary of the SMPTE have been a major contribution in bringing the Society to its present high level of prestige and accomplishment.*"

In addition to being a Fellow of the SMPTE, Boyce is International Secretary for motion pictures of the International Standardization Organization, in which capacity he participated in the standardization conference in Stockholm in June 1955, and a member of the Council of Engineering Society Secretaries. He is also a member of the American Management Association, Council of Executives of Organization Members of the American Standards Association, Trade Association Executives of New York, President's Industrial Safety Conference and the Engineers' Club of New York.

High-Speed Photography Congress

The Third International Congress on High-Speed Photography opens in London, Monday, September 10. The following skeleton time table has been released by John H. Waddell:

Monday, 10th September:
A.M. Official Opening of Congress and Exhibition
P.M. *Session I:* Flash Light Sources (*3 papers*) *Session II:* Flash Light Sources (*5 papers*)

Tuesday, 11th September:
A.M. *Session III:* Image-Sampling Technique (*3 papers*)
Session IV: Inertialess Shutters (*4 papers*)
P.M. *Session V:* Applications:
(1) Biology and Medicine; and (2) Machine Analysis (*5 papers*)
Session VI: Ballistics and Explosives (*4 papers*)
Evening Popular Session

Wednesday, 12th September:
A.M. *Session VII:* Photog. Materials (*3 papers*) *Session VIII:* Instrument Aids (*4 papers*)
P.M. No Lectures

Thursday, 13th September:
A.M. *Session IX-A:* X-Rays (*2 papers*) *Session IX-B:* Terminology (*1 paper*)
Session X: Film Evaluation (*4 papers*)
P.M. *Session XI:* Schlieren, Interferometric Stereoscopic, Colour Photomicrography (*3 papers*)
Session XII: Mechanical Optical Drum Cameras (*6 papers*)
Evening Popular Session

Friday, 14th September:
A.M. *Session XIII:* Review (*2 papers*)
Session XIV: Medium Repetition Rate Camera (*3 papers*)
P.M. *Session XV:* Aerodynamics (*2 papers*) *Session XVI:* Hydrodynamics (*5 papers*)

Announcements appeared earlier in the *Journal* in March (p. 174) and April (p. 229), the latter describing the special Pan American World Airways flight plans. Further information may be obtained from John H. Waddell, 88–06 Van Wyck Expressway, Jamaica 1, N.Y.

Education, Industry News

The Inter-Society Color Council held its 25th annual meeting April 5 and 6 at the Statler Hotel, New York. Entitled "Color Problems in the Graphic Arts," the meeting included twelve reports. Principal speaker at the closing dinner session was Ralph M. Evans, color technologist at the Eastman Kodak Co. and Council secretary.

During the meeting, Robert W. Burnham, research psychologist in Eastman Kodak's Color Technology Div., reported on basic elements of color education. In a paper, "How We See Color," he earlier described some of the methods used for measuring and specifying color in psychological experiments. Color, to a psychologist, Burnham said, is "all in the head." He urged that persons professionally interested in the use of color rely on the "firmly established" developments and discoveries of psychologists, physicists and physiologists. He reviewed the major factors that affect our color seeing.

Arthur J. Miller has been appointed Technical Director of Pathé Laboratories, Inc. In addition to his duties as the Laboratories' technical director, he will organize and supervise development methods in Pathecolor, Inc., a new subsidiary of Pathé Labs. Before his present appointment, Miller was director of American Optical Company's motion-picture printing department.

Walter R. J. Brown, research physicist at Eastman Kodak Co., Rochester, N.Y., was awarded the Adolph Lomb Medal of the Optical Society of America at that Society's Spring Conference. The award was for achievements in varied fields of color photography. He contributed "A Rapid-Scanning Microdensitometer" to this Society's *Journal* in October 1954.

The Scientific Film Review, Journal of the Scientific Film Association, 164 Shaftesbury Ave. London, W.C.2, came out in a new format for its April issue. The new journal will appear every second month. Three issues a year will contain film reviews and appraisals, together with articles on various aspects of scientific and industrial films. The other three issues will generally be devoted to films on specific subjects. The first special issue of this kind will be published in June and will be devoted to films on Chemistry.

Amateur motion-picture projector lamps are covered by Code C78.370–1956 of the American Standards Association, for designating and identifying interchangeable lamps used in projectors and other photographic equipment. Among firms now using the coding system are General Electric, Westinghouse and Sylvania.

Technical Digests, United States Edition, has made its appearance as vol. 1, no. 1, January 1956. Having to do often with new methods of manufacture or newly manufactured components or equipments, it also covers some administrative and service developments. We are promised that European developments in communications will be included. About 1,000 European periodicals are to be surveyed regularly and from them articles likely to be effective in increasing productivity are selected. Simply written digests of the selected articles are prepared and issued in English and French, to the member countries of the Organization for European Economic Co-operation. Some of these countries, for instance Austria, Germany, Italy and Norway, prepare their own language editions. Originating with the European Productivity Agency, 3 Rue Andre-Pascal, Paris 16, the U.S. edition of Technical Digests subscriptions are handled by the O.E.E.C. Mission Publication Office, 2000 P St., N.W., Washington, D.C., at the rates of $24 a year or $2.50 for a single issue.

Industrial Audio-Visual Association

The IAVA is composed of a group of men concerned with the improvement of the production and presentation of audio-visual material for business and industrial organizations. It was founded in 1948 in Chicago by several men engaged in audio-visual work who found discussion of mutual interests and problems helpful and therefore decided to enlarge into an Association but at the same time remain small enough to maintain strictly their primary activity: a full interchange of information between members. Membership is therefore limited to 100 males.

The purpose of IAVA is: (1) to study all means of audio and visual communication including creation, production, appreciation, use and distribution; (2) to promote better standards and equipment; and (3) to establish a high concept of ethics in the relations of members. Two national meetings are held each year, one usually in the Midwest and the other in the East. Officers are elected annually. Panel discussions by members and speeches and demonstrations by members and nonmembers make up the programs.

Prerequisites for membership are that the men must be those who: (1) are responsible for audio-visual activities for nontheatrical commercial or industrial firms, who desire to study and solve audio-visual problems, and who are willing to exchange on a professional basis their ideas and experiences in the audio-visual field; (2) have no remunerative interest in firms or organizations engaged in creating, designing, manufacturing or selling audio-visual media and equipment; and (3) do not represent associations, agencies, special consultants, counsellors, educational institutions, societies or professional research organizations.

President of the Association is Frederick G. Beach, of Remington-Rand, Inc., New York; the Secretary is Alan W. Morrison, Socony Mobil Oil Co., Inc., New York.

Membership Certificates (Active and Associate members only). Attractive hand-engrossed certificates, suitable for framing for display in offices or homes, may be obtained by writing to Society headquarters, at 55 West 42d St., New York 36, Price: $2.50.

section reports

The Pacific Coast Section's April meeting was held April 17 at the Paramount Studios, Hollywood.

Charles W. Handley spoke on "The Application of Yellow Flame Carbons in Motion-Picture Studios." The talk centered around the development and application of the 225-amp motion-picture studio carbon to color film production. This newly developed carbon was awarded a Class I Scientific Technical Award. Film tests made by the Motion Picture Research Council were shown. The tests were described and the films narrated by Petro Vlahos of the Motion Picture Research Council.

Dr. Norwood L. Simmons discussed activities of the SMPTE Television Committee in formulating specifications for color motion-picture test films and slides for color television. Carlos H. Elmer of the U.S. Naval Ordnance Test Station described the specialized photographic instruments used by NOTS in the Navy's rocket and guided missile development and test program.

The Face of Lincoln, the University of Southern California's Academy Award winning two-reel short subject, was shown. Ed Freed, director of the film, discussed problems encountered during the production of the film.—*E. W. Templin*, Chairman, c/o Westrex Corp., 6601 Romaine St., Hollywood 38.

The Northeastern Section met April 18 in the Color Room of the Eastman House, Rochester, N.Y. Approximately 80 members were present, including some 10 persons from out of town.

John A. Maurer, former president of J. A. Maurer, Inc., and Precision Film Labs, spoke on "Technical Possibilities in the 16mm and 8mm Fields." He pointed to a number of shortcomings in the present 8 mm and 16mm cameras, projectors, printers and sound recording systems. He said that it is now possible to make 16mm sound films with quality as good as the 35mm of a few years ago, and suggested that with certain improvements now being studied it should be possible in the near future to produce 8mm sound film with quality as good as the average 16mm film of today.—Mr. Maurer described some of the work which he is now doing in the development of an improved optical 16mm step printer which will include frame line correction. He also proposed some improvements in the condenser lens, the gate and the sound reproducer for 16mm projectors.—*G. T. Negus*, Secretary-Treasurer, c/o Eastman Kodak Co., Kodak Park Works, Bldg. 65, Color Technology Div., Rochester 4, N.Y.

Northwestern Section met April 24 at the Leo Diner Film Studios, San Francisco. Managers were appointed for the term of office continuing until the Fall elections. They are: W. A. Palmer, Palmer Films, Inc.; Lee Berryhill, KRON-TV; Harry N. Jacobs, KGO-TV; Wm. E. Evans, Jr., Stanford Research Institute; Ross H. Snyder, Ampex Corp.; and Don Monaco, Specialty Eng. Co.

Principal topic of discussion was the new Eastman Type 5269 color film. Ray Grant of Eastman Kodak Co. gave a talk on the film and a demonstration of its qualities. W. A. Palmer, Palmer Films, Inc., offered comments on tests of the new film. Leo Diner conducted a tour of the Studio and explained facilities now being developed.—*R. A. Isberg*, Secretary-Treasurer, Consulting Television Engineer, 2001 Barbara Dr., Palo Alto, Calif.

New Members

The following members have been added to the Society's rolls since those last published. The designations of grades are the same as those used in the 1956 MEMBERSHIP DIRECTORY.

Honorary (H) Fellow (F) Active (M) Associate (A) Student (S)

This is the first list of New Members supplementing the April Journal, Part II, Directory.

Aloisi, Aurora Barbara, SRT-TV Studios. Mail: 2019 Hughes Ave., Bronx 57, N.Y. (S)

Althoff, George Alfred, Project Eng., Embe Gear Works. Mail: 335 W. Broadway, Glendale, Calif. (M)

Anderson, David W., Chief Electrician, 20th Century-Fox Film Corp. Mail: 542 Muskingum Pl., Pacific Palisades, Calif. (A)

IF AT FIRST YOU DON'T SUCCEED, TRY, TRY, TRY AGAIN . . . *

This is excellent advice for mountain climbers, aspiring writers and pole-vaulters. There are some situations, however, to which it does not apply.

We're thinking of parachutists, for example—and film laboratories.

A film lab loses precious time for the producer while 'trying, trying and trying again' to arrive at a satisfactory print. And in the case of negative, of course, there is no second try.

For parachutists we have no counter-advice. For film producers we recommend the complete 16mm and 35mm services including 16mm color printing offered by . . .

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*W. E. HICKSON

Antonio, James F., Cameraman, Free-Lance, 45 Florence Ave., West Haven, Conn. (A)

Apsel, Lowell, Radio Corp. of America. Mail: 1560 Unionport Rd., Bronx 62, N. Y. (S)

Armour, Allan A., N. Y. Univ. Mail: 3738 Cypress Ave., Brooklyn, N.Y. (S)

Atrochin, Capt. Paul Anthony, Army Pict. Center. Mail: 548 Paul St., Hillside, N.J. (M)

Baer, William Henry, Film Lab. Coordinator, National Broadcasting Co. Mail: 1100 Margaret St., W. Englewood, N.J. (A)

Baker, Arnold Frank, Univ. of So. Calif. Mail: 2617 Ellendale Pl., Los Angeles. (S)

Baker, Lt. Stanley A., Mot-Pic. Project Officer, Mail: Hqs. APCS, Box 137, Orlando AFB, Orlando, Fla. (A)

Barecky, William J., Film Technician, Eastman Kodak. Mail: 2401 Effie St., Los Angeles 26, Calif. (A)

Barnes, Marvin Faye, Jr., Mot.-Pic. Film Editor, U.S. Naval Photographic Center, NAS, Anacostia 25, D.C. (A)

Beck, Eldridge C., Quality Control Staff Supvr., Eastman Kodak Co. Mail: 16121 Hamlin St., Van Nuys, Calif. (A)

Bellavia, Michael Frank, Quality Control Eng., Eastman Kodak Co. Mail: 6034 Whitsett Ave., N. Hollywood. (A)

Bennett, Charles Ansel, Northeastern Univ. Mail: 85 Grove St., Quincy 69, Mass. (S)

Berner, Robert John, Film Technician, General Film Labs. Mail: 22021 De La Guerra, Woodland Hills, Calif. (A)

Blitz, Daniel, Electronic Eng., Sanders Associates, Inc. Mail: 210 Bay State Rd., Boston 15 (M)

Bodrero, Alessandro Spalding, Cartoon Cameraman, Walt Disney Prods. Mail: 495 Buena Vista St., San Marino, Calif. (A)

Bonnifield, Beau, Sound Technician, Republic Prod., Inc. Mail: Box 2406, Hollywood 28. (A)

Boyar, Milton Charles, Chemist, Eastman Kodak Co. Mail: 12634 Divan Pl., N. Hollywood. (A)

Boyle, John W. Michael, Foreman, 35mm Lab., Eastman Kodak Co. Mail: 1691 N. Crescent Heights Blvd., Hollywood 46. (A)

Brick, Gene R., Radio & TV Eng., WCHS-TV. Mail: 732½ Bigley Ave., Charleston, W. Va. (A)

Bryske, Joseph J., Quality Control Eng., Eastman Kodak Co. Mail: 4811 Melrose Ave., Los Angeles 29, (A)

Bryson, Max Folland, Assist. Secy. Mail: General Film Labs., Inc., 7022 McLennan, Van Nuys, Calif. (A)

Burk, Gordon N., Univ. So. Calif. Mail: 2107 Fox Hills Dr., Los Angeles 25. (S)

Carrier, Glen Russell, Producer & Equipment Supplier. Mail: 229 E. Randolph St., Lansing, Mich. (A)

Clark, Lawrence A., Jr., Sch. Modern Photo. Mail: 9264 216 St., Queens Village, N.Y. (S)

Cox, William Goodman, Public Relations, Mot.-Pic., Northrop Aircraft, Inc. Mail: 2900 Sawtelle Blvd., Los Angeles 64. (A)

Crutchfield, Archie Eugene, Mot.-Pic. Sound Technician, USAF. Mail: 1123 Support Sqdn., Box 73, Alabama Hall, Ft. Myer (South Area), Arlington 8, Va. (A)

Cevetello, John Joseph, SRT-TV Studios. Mail: 1866 Hudson Blvd., Jersey City, N.J. (S)

Cvetic, John Joseph, TV Broadcast Technician, Westinghouse Broadcasting Co. Mail: 5100 Butler St., Pittsburgh 1, Pa.

Dahl, Carl Elmer, Oscar F. Carlson Co. Mail: 5227 N. Normandy Ave., Chicago, Ill. (A)

Dailey, Glenn E., Shop Supt., Oscar F. Carlson Co. Mail: 604 S. School St., Mt. Prospect, Ill. (A)

Dennis, Jean Marion, Film Processing, Eastman Kodak Co. Mail: 1641 N. Alexandria, Los Angeles 27. (A)

Doll, James Hood, Radio Technician, WCAE, Inc. Mail: 429 Ferguson Rd., Allison Park, Pa. (A)

Doran, Neal Gordon, Station Electronic Tech., Pacific Telephone & Telegraph. Mail: 1260 N. Las Palmas Ave., Hollywood 38. (A)

Dosunmu, Hammed T. A., Supvr. Radio-Cinemat. Eng., U.S. Information Service, Mail: 2, Dosunmu Court, Lagos, Nigeria. (M)

Eisgrau, Morton Ira, SRT-TV Studios. Mail: 63 Fremont St., Harrison, N.Y. (S)

Eisenstat, Nathan Photo., King Camera Centre. Mail: 147 Ranee Ave., Toronto, Ont., Can. (A)

Emeritz, Raymond William, Camera Repair, Camera Equipment Co. Mail: 136 Springtime Lane, W., Levittown, N.Y. (A)

Erde, Bernard, Research Eng., Columbia Broadcasting System. Mail: 178 Ocean Parkway, Brooklyn 18, N.Y. (M)

Esparza, Rafael Ruiz, Sound Engineer, Cinematografica Latino Americana. Mail: Ave. dos No. 31-Bis., Mexico 18, D.F. (A)

Epting, Roy William, Jr., Control Chemist Photo., Perfect Photo, 4747 N. Broad St., Philadelphia. (A)

Findlay, William, Sales Eng., Westrex Corp. Mail: 2131 Cahuenga Blvd., Apt. 14, Hollywood. (A)

Ford, Malcolm H. C., Sound Eng., Gaumont Kalee Theatre Supplies, 50 Mortimore St., Moorabbin, Vic., Australia. (M)

Francisco, Ramon Perez, Technician, Free-Lance, S. M. Berger & Co., Inc., Quiapo Manila, P.I. (A)

Funk, Nelson S., Sound Technician, Ankers Prod. Mail: 3312 Jones Bridge Rd., Chevy Chase, Md. (A)

Geschtberg, Philip, School of Modern Photography. Mail: 205 Murray St., Elizabeth, N.J. (S)

Girola, Louis J., Sales Eng., Houston Fearless. Mail: 42 Garnet La., Plainview, N.Y. (A)

Goddard, Garth Fraser, TV Technician, Canadian Broadcasting Corp. Mail: 134 Lawton Blvd., Apt. 405, Toronto 7, Ontario. (A)

Goldstein, Charles, Executive, Reela Films, Inc., 17 N.W. Third St., Miami, Fla. (A)

Graham, William L., Eng., Goldberg Bros. Mail: 39 Bryant Way, Denver 19, Colo. (A)

Gularek, Theodore V., Jr., Draftsman, Westrex Corp. Mail: 185 Greenpoint Ave., Brooklyn 22, N.Y. (A)

Gurunian, George, TV Eng., National Broadcasting Co. Mail: 4435 Tyrone Ave., Sherman Oaks, Calif. (A)

Guttman, Eric I., Chem. Eng., Eastman Kodak Co., Kodak Park B. 35, Rochester, N.Y. (A)

Harding, Bruce E., Assistant Director, Harvard University. Mail: Hobart & Union Sts., E. Bridgewater, Mass. (M)

Harris, John Richard, Dir., Central Photographic Facility, Montana State Univ. Mail: Box 118, Missoula, Mont. (A)

Hess, Max Elden, Film Techn., Eastman Kodak. Mail: 6039 Traymore Ave., Azusa, Calif. (A)

Hill, Richard E., Techn., Columbia Broadcasting System. Mail: 14325 Millbrook Dr., Sherman Oaks, Calif. (A)

Hoei, Tong Dian, Sales, Theatre Supply, Cinemat. Equip. Mail: Djl. Indramaju 26, Djakarta, Indonesia. (A)

Hoffman, William V., Da-Lite Screen Co. Mail: 206 N. Home Avenue, Park Ridge, Ill. (A)

Hudson, F. D., Executive Vice-Pres., Binghamton Magnetic Ind. Mail: 40 Dickinson Ave., Port Dickinson, Binghamton, N. Y. (A)

Hughes, William Maurice, Photo., Pacific Title & Art Studios. Mail: 1128 Heliotrope Dr., Los Angeles 29. (M)

Hunsicker, Robert K., Western Dist. Mgr., General Precision Laboratory. Mail: 331 E. San Gabriel Court, Sierra Madre, Calif. (M)

James, Ralph Edward, Mot.-Pic. Producer, Director, Cameraman, Sound-on-Film Prod. Mail: 2809 North Gate Dr., N. Sacramento 15, Calif. (M)

Jones, Gaylord Dodge, Foreman, Color Film Processing, Eastman Kodak Co. Mail: 1140 Tamarind Ave., Hollywood. (A)

Kadow, Francis Mangin, Theater Owner, Radio Station Owner, 835 N. Fifth St., Manitowoc, Wisc.

Kallman, Hjalmar J., Oscar F. Carlson Co. Mail: 5325 N. Meade, Chicago. (A)

Keenahan, Harold William, Photo. Color Chemist, Eastman Kodak Co. Mail: 6247 Farmdale Ave., N. Hollywood. (A)

Keene, George Thomas, Photo. Eng., Eastman Kodak Co. Mail: 76 Westland Ave., Rochester 18, N.Y. (M)

Keller, Weldon Phillips, Brooks Inst. Photo. Mail: 309 Foul Bay Rd., Victoria, B.C., Can. (S)

Kepner, William Chase, Photo. Supvr., New Holland Machine Co., New Holland, Pa. (M)

Kidder, Marvin E., Chemical Analyst, Eastman Kodak Co. Mail: 7641 Boeing Ave., Los Angeles. (A)

Koerner, Otto H., Chemical Analyst, Eastman Kodak Co. Mail: 11453 Laurel Crest Dr., N. Hollywood. (A)

Komatsu, Soichi, Chief, Optical Designing Sec., KOWH Optical Works, 1227 Kamigahama, Fusocho, Gamagori City, Aichi-Pref, Japan. (A)

Kossuth, Arden Keith, TV Eng., Wayne Univ. Mail: 239 Cedarhurst, Detroit 3. (A)

Kroef, Jan James, Tech. Mgr., Kodak (Malaya) Ltd., 130 Robinson Rd., Singapore, Malaya. (M)

Kronemyer, Jack R., Mot.-Pic. Sales, Ansco. Mail: 15 Oak St., Teaneck, N.J. (A)

Lambert, Tom, Sound Mixer & Sound Supvr., Lindsley Parsons Prod. Mail: Box 254-C, Route 1, Newhall, Calif. (M)

Leidy, Lester W., Mgr., Electronic Eng. Services, RCA Service Co. Mail: 305 Mt. Vernon Ave., Haddonfield, N.J. (M)

Levens, Philip J., TV Eng., Dir., Trinity Telefilms Ltd., 871 Seventh Ave., Rm. 1506, New York 19. (A)

McClelland, Lefferts A., Dir. of Operations, National Broadcasting Co. Mail: 4405 S. First St., Arlington, Va. (M)

McCrimmon, Alasdair Murray, Film Editor, Chetwynd Films Ltd. Mail: 74 Elm Ave., Toronto 5, Ont., Can. (A)

Malang, Albert William, TV Maint. Eng., American Broadcasting Co. Mail: 89-10 35 Ave., Jackson Heights 72, N.Y. (A)

Malm, Margaret, Lakeside Laboratory. Mail: 318 W. 49 Ave., Gary, Ind. (M)

Mann, Howard A., Film Editor, Hartley Prod. Mail: 345 W. 4 St., New York 14. (A)

Martin, James Arensberg, Univ. Miami. Mail: 6000 San Amar Dr., Coral Gables, Fla. (S)

Martin, Robert John, Head of Camera Dept., Parthenon Pictures, 2625 Temple St., Hollywood 26. (M)

Meagher, James Albert, Meagher Electronics Co. Mail: 392 Spruce Ave., Pacific Grove, Calif. (M)

Meindl, Eugene Francis, Univ. Miami. Mail: 14140 N.E. 8 Ave., N. Miami, Fla. (S)

Meyer, Harry L., Chemist, American Optical Co. Mail: 278 Greve Dr., New Milford, N.J. (A)

Millikin, Robert J., Staff Specialist, Vitro Corp. of America. Mail: 619 Thames St., Ft. Walton Beach, Fla. (A)

Monaco, Dan D., Mot.-Pic. Laboratory, Independent. Mail: 2434 Leavenworth St., San Francisco. (M)

Nafshun, Irwin, Sound Technician, Cinesound Co. Mail: 8626 Olin, Los Angeles. (A)

Nelson, John Everett, Mot.-Pic. Lab. Technician, Byron, Inc. Mail: 303 Fairchester Dr., Fairfax, Va. (A)

Neyhierl, Robert J., Department Head. Mail: Pathe Color, 717 Ave. A, Bayonne, N.J. (A)

Notz, Donald George, Production Asst., Arthur Andersen & Co. Mail: 2523 N. Harding, Chicago 47. (A)

O'Brien, D. L., Branch Mgr., Altec Service Corp. Mail: 10952 Roebling Ave., Los Angeles 24, (M)

Olson, Richard Howard, Sound Eng., Radio Corp. of America. Mail: 1445 Poppy Peak Dr., Pasadena 2, Calif. (A)

Palmer, Donald Alfred, Mot.-Pic. Production, Alfred T. Palmer Prod. Mail: 15 Selborne Dr., Piedmont 11, Calif. (A)

Parker, Clyde Eugene, Mot.-Pic., Photo. USAF. Mail: 45420 Genoa St., Lancaster, Calif. (A)

Pascuzzi, Louis F., 34 Dell Ave., Mt. Vernon, N.Y. (A)

Petersen, William H., Supvr., Meletron Corp., Mail: 3415 Bentley Ave., Los Angeles 34. (A)

Pilkington, Thomas, Sensitometric Foreman, Film Tech., Pathe Labs. Mail: 823 N. June St., Hollywood 38. (A)

Platt, Sidney, Univ. Miami. Mail: 711 S.W. 16 Ave., Miami, Fla. (S)

Popoff, John A., Yorkton Collegiate Inst. Mail: 184 Maple Ave., Yorkton, Sask., Can. (S)

Porter, Francis Sydney Bedford, Tech., Columbia Broadcasting System. Mail: 43-14 60 St., Woodside 77, N.Y. (M)

Raftery, James J., Race Track Photo., Gulfstream Park. Mail: 3200 N.W. 79 St., Miami, Fla. (A)

Retter, Henry Helmuth, Civil Eng., Private Practice. Mail: 6F Ove Sur. No. 7, San Salvador, Central America (A)

Rosner, Irv, TV Broadcasting, Columbia Broadcasting System. Mail: 245 E. 34 St., Brooklyn N.Y. (A)

Sacks, Mitchell, TV Workshop. Mail: 734 E. Ninth St., New York 9. (S)

Sawyer, Elbert Lowrance, Cine Processor, Eastman Kodak Co. Mail: 2071 Vista Del Mar Ave., Hollywood 28. (A)

Schwartz, Morton, City Col. N.Y. Mail: 1997 Hughes Ave., New York 57. (S)

Schwartz, William Julius, Sound Recording Techn., IATSE Local 52. Mail: 4209 47 Ave., Long Island City 4, N.Y. (M)

Scott, M. L. A., Service Eng., Altec Service Corp. Mail: 10157 Slusher Ave., Tujunga, Calif. (M)

Sherer, Louis Edward, Film Processing, Eastman Kodak Co. Mail: 13166 Orthey Pl., Van Nuys, Calif. (A)

Shutes, Ogden L., Univ. So. Calif. Mail: 2001 N. Hillcrest Rd., Hollywood 28. (S)

Siegler, Alvin Jay, TV Eng., Columbia Broadcasting System. Mail: 727 Brower Ave., Franklin Square, N.Y. (A)

Shoemaker, George H., Radio-TV Eng. American Broadcasting Co. Mail: 3515 Fillmore St., San Francisco 23. (A)

Simonic, Richard Berry, Ind. Tech. Col. Mail: 1211 Elm St., Fort Wayne, Ind. (S)

Smith, Don E., TV Eng., Cinemat., KLRJ-TV. Mail: 225 N. 15 St., Las Vegas, Nev. (M)

Smith, Martin Luther, Univ. Miami. Mail: 760 N.E. 141 St., N. Miami, Fla. (S)

Squire, Barbara Kay, Univ. So. Calif. Mail: 6018 Shenandoah Ave., Los Angeles 56. (S)

Stein, Maurice M., Positive Assembly Foreman, General Film Labs. Mail: 3601 Laurel Canyon Blvd., Studio City, Calif.

Suchesk, Arthur Mickey, Sound Engineer, Cinesound Co. Mail: 4783 Firmament Ave., Encino, Calif. (A)

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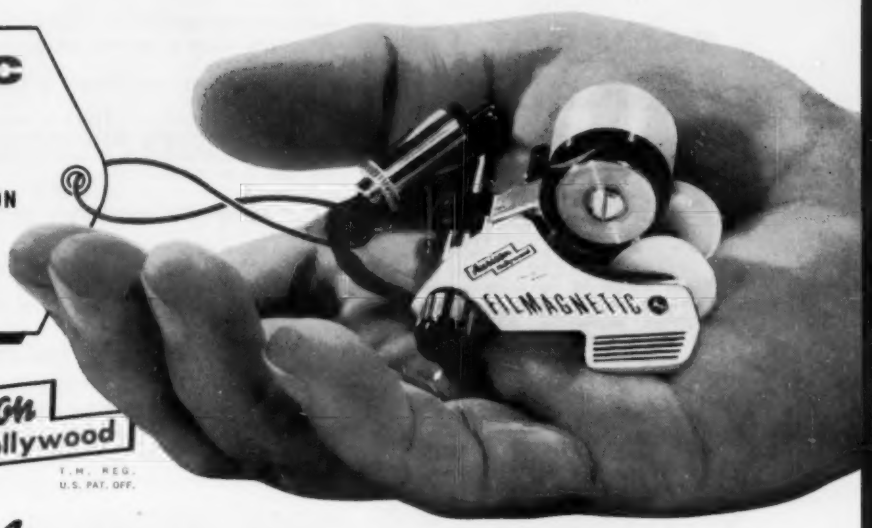

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current literature

The Editors present for convenient reference a list of articles dealing with subjects cognate to motion-picture engineering published in a number of selected journals. Photostatic or microfilm copies of articles in magazines that are available may be obtained from The Library of Congress, Washington, D.C., or from the New York Public Library, New York, N.Y., at prevailing rates.

American Cinematographer vol. 37, Mar. 1956

Arthur Miller Looks at Electronicam (p. 154) *A. Miller*

Brightest Incandescent Lamp Powered by Radio Impulses (p. 156) *C. Loring*

Systematic Control for Special Effects in 16mm Production (p. 162) *H. Harvey* and *C. Lacey*

Coincident Sound for Home Movies. Pt. 2 (p. 166) *J. N. Whitaker*

vol. 37, Feb. 1956

Pictorial Emphasis in Cinematography (p. 86 *A. Rowan*

Shooting without a Tripod (p. 88) *F. Foster*

New Blimp for the Camerette (p. 90) *L. Allen*

Shakespeare in VistaVision (p. 94) *H. Benson*

The Preparation of Short Technical Films (p. 98) *K. H. Barney*

Bild und Ton vol. 9, Mar. 1956

Das Prokimaskop (p. 61) *R. Tiedeken*

British Kinematography vol. 28, Feb. 1956

Special Effects for Television (p. 41) *A. M. Spooner*

Electronics vol. 29, Apr. 1956

Correction Circuits for Color TV Transmitters (p. 130) *K. E. Mullender* and *R. McMann, Jr.*

Institution of Electrical Engineers, Journal vol. 2, Feb. 1956

The Principles of N.T.S.C. Color Television (p. 89) *C. J. Hirsch*

Institute of Radio Engineers, Proc. vol. 44, Mar. 1956

Color Television Receiver Design—A Review of Current Practice (p. 297) *R. G. Clapp, E. G. Clark, G. Hoxitt, H. E. Beste, E. E. Sanford* and *R. J. Farber*

International Projectionist vol. 31, Feb. 1956

Acoustics in Projection (p. 7) *M. Stevens*

Eliminating Fire Hazards in the Motion Picture Theatre (p. 12) *N. Wasserman*

How Superscope Prints Are Made (p. 14)

Color and Its Reproduction on Film (p. 16) *R. A. Mitchell*

vol. 31, Mar. 1956

Film and the Heat Problem (p. 7) *R. A. Mitchell*

Special Projection Process Gives 'Fantasia' New Look (p. 14) *N. Wasserman*

The Versatile Claw Intermittent (p. 16) *J. Ruiz*

Kino-Technik vol. 10, Jan. 1956

Kino-Bau und -Einrichtung (p. 4)

Akustische Voraussetzungen beim Bau von Filmtheatern (p. 8)

Einwandfreie Tonwiedergabe durch gute Raumakustik (p. 10) *H. Michel*

Gestaltung lufttechnischer Anlagen für Filmtheater (p. 14) *Kahoun*

Filmvorführung im richtigen Seitenverhältnis (p. 16)

Die Kinotechnik nach Einführung des Sicherheitsfilms (p. 17) *H. Tümmel*

Die neue "Arricord 35"-Magnetton-Bildkamera (p. 24) *W. Selle*

Variationsmöglichkeiten des Schmalfilmformates (p. 28) *G. Schwieger*

VistaVision entwickelte jetzt auch eine Handkamera (p. 31) *W. Beyer*

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Optimale Helligkeits- und Farbenwiedergabe beim Kopieren von Color-Filmen (p. 40) *C. R. Anderson, C. E. Osborne, F. A. Richey* and *W. L. Swift*

Agfacolor-Negativ Typ 3—sensitometrisch betrachtet (p. 44) *Dr. Kuhn*

Die Farbsteuerung im kinematographischen Kopierprozess (p. 46) *Dr. Busch*

Die Herstellung von Theaterkopien mit Magnettonspur (p. 48) *W. Jahn*

Die chemische Kontrolle von Verarbeitungsbädern (p. 50)

Du Pont "Cronar"-Polyester–ein neuentwickelter Filmträger (p. 58)

Maschinelle Filmentwicklung bei vollem Tageslicht (p. 62) *L. Busch*

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In welcher Richtung entwickelt sich die Tonfilmtechnik? (p. 72) *E. Kammerer*

Eine neue Technik: CinemaScope mit 55mm breitem Film (p. 74) *W. Jahn*

Objektiv-Vorsätze für die anamorphotischen Verfahren (p. 77) *Dr. Leder*

CinemaScope vom Standpunkt der physiologischen Optik (p. 80) *W. Dinkelacker*

Der Magnettonfilm in der Lichtspieltheater-Praxis (p. 82) *W. Pahl*

Aufgabe des Effektkanals und Einbau der Lautsprecher (p. 88) *W. Struve*

Testfilm zum Messen der Spaltlage von Magnetköpfen (p. 94)

Siemens & Halske: Bespurungsmachine für Magnetfilm (p. 100)

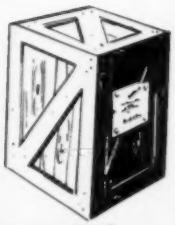
Philips Technical Review vol. 17, Apr. 1956

A Cinema Projector for 70mm and 35mm Films (p. 299) *J. J. Kotte*

Radio & Television News vol. 55, Apr. 1956

Portable Geiger Counter (p. 57) *R. L. Ives*

Bell Labs Designs New V.H.F. Transistor (p. 124)



new products

(and developments)

Further information about these items can be obtained direct from the addresses given. As in the case of technical papers, the Society is not responsible for manufacturers' statements, and publication of these items does not constitute endorsement of the products or services.

A New Magnetic Video Recording System

BY CHARLES P. GINSBURG

[This paper presents a brief history of the project, a description of the equipment and a discussion of the applications for which it was designed. A full engineering report, with display and demonstrations, has been promised for the Fall Convention in Hollywood. The following is abstracted from the presentation made on May 2, 1956, at the Society's Convention in New York by Ross H. Snyder, Ampex Corp., Redwood City, Calif., for the author. An earlier report appeared in this column in the April 1954 Journal, pp. 323–4.]

In the fall of 1951, three members of Ampex management, all engineers, decided to commit a part of the company's capital to a research and development project aimed at the production of a practical magnetic tape recorder of video electrical signals. These were Alexander M. Poniatoff, now Board Chairman, Walter Selsted and Myron Stolaroff, now assistants to Ampex' President, George I. Long. Their interest had been aroused by the rotary head approach to the problem of wideband recording, the geometry indicating a possibility that a practical machine might by this means operate at high tracing velocity, yet at comparatively low tape speed. In December of that year, Charles P. Ginsburg, a broadcast television engineer of San Francisco, was brought to the company's Redwood City Laboratory with this specific project in view. Ampex was, at that time, a company of less than two hundred employees.

It was not until four years later that we knew our approach was workable, and that practical machinery positively could come out of it. The problems which arose, one after the other, each seemed insurmountable, and each was solved by one or another of the six-man engineering team, working in a locked laboratory. As an example of the rate at which development is still going on, the whole size of the machine now may be reduced by the success of experiments with one-mil-base Mylar magnetic tape, with which 64 min of program material can be contained on a 12-in. reel rather than the 14-in. reels contemplated earlier.

The console of the VR-1000 Videotape Recorder is entirely self-contained. There are two input connections — one for video and one for audio — connections for audio and video monitors, two program output connectors, and a 117-v single-phase 60-cycle power cable, which draws no more than 3½ kw. There are no special requirements for its installation or operation. The entire equipment weighs approximately 900 lb, and can be moved through a 3-ft door.

The operation of the machine is in every way like that of an Ampex audio tape recorder. Threading requires less than 30 sec. There are the familiar pushbutton controls for "Play," "Record," "Stop," "Rewind" and "Fast Forward." Provision is made for remote pushbutton control. The buttons even *feel* the same as the controls on an Ampex Model 350, the professional audio recorder which gave its transport and control apparatus to the VR-1000 Videotape Recorder. Other controls are for purposes familiar to video operators anywhere. All internal circuitry will be immediately familiar to any qualified video engineer, and there is no requirement for special service facilities.

The machine which was shown at Chicago in April 1956 would play or record without interruption for 64 min, using 4800 ft of magnetic tape 2 in. wide on a 14-in. diameter reel. The 64-min recording or playing time is a basic specification of future production equipment. The tape moves at the standard audio speed of 15 in./sec, while four heads revolve transverse to the tape motion at high velocity. A soundtrack is laid down along one edge of the tape in the normal manner, using the usual Ampex bias and equalization circuitry. Tape entirely suitable for use with the machine is available from each of the four major suppliers.

Stability of operation meets video broadcast standards. The relative timing of any two scanning lines in any group of 20 adjacent lines is reproduced on any machine to an accuracy of 1 part in 600. No evidence of horizontal instability is detectable on a studio monitor of RCA 630TS synchronizing circuitry. Field-to-field stability is held to a degree equivalent to no more than 10% error of interlace on the reproduced picture. Video-level changes between record input and playback output, due to differences in output among the four revolving heads, are in every case more than 40 db below the peak-to-peak video level. The playback level of 15.75 kc pulses will not vary more than 1 db in any half-hour, nor more than 0.1 db in periods of 1/60 of a sec to 5 sec. There is no measurable difference whatever in the playback signals, whether they are reproduced immediately, or delayed a month or more. This depends much more upon the tape than on the machine, and the indications are that storage problems will not be substantially different with Videotape than with audio tape recordings.

Much of the operational stability of the machine derives from a refined version of the powerline lock-in drive described in 1950 to the SMPTE by Walter Selsted (September 1950 *Journal*). A control track is continuously recorded on the tape at a frequency which corresponds to that of the power line. Small variations are thus recorded for future reference. During play-

back, an electronic servo compares power-line frequency recorded with that being supplied, and issues a correction signal to the tape-drive mechanism, resulting in a steadiness which gives the specified video stability.

Other operating parameters of the Videotape Recorder include:

(1) The machine comes to full, stable operating speed in 4 sec from dead stop, and is automatically blanked out until stable speed is reached.

(2) A rewind time of approximately 1 min 40 sec for the full hour recording is provided. You might expect this, since the machine uses the same tape transport as that on a standard professional audio recorder.

(3) A horizontal resolution of 320 lines.

(4) Video bandwidth of 4 mc.

(5) Video peak-to-peak signal-to-noise ratio of 30 db or more.

(6) Audio soundtrack with frequency response beyond 10,000 cycles, signal-to-noise ratio of more than 50 db.

An audio cue track of limited quality is also included. This is a second and separate soundtrack from the program channel, and is recorded along the same tape in synchronism with the picture. Its purpose is the verbal recording of routine directions or notes to accompany the playback. It may be used, for example, to cue upcoming programs or spots, to direct editing, or to give warning before the end of the tape. Its response is limited to the band of 50 to 3000 cycles.

The machine was designed specifically for the purpose of program delay, and it is for this purpose only that it will be first employed by CBS and NBC, to overcome the 3-hour East-West time difference. In this service the equipment will make possible both improved quality of picture *and* sound, and reduced annual operating costs. Usefulness of the Videotape apparatus for other purposes awaits exploration *after* experience is gained with the equipment in actual operation by NBC and CBS. A word of caution is entirely in order here. The VR-1000 is a wideband magnetic recorder, capable of continuous presentation of previously recorded electrical intelligence with a bandwidth of 4 mc and signal-to-noise ratio of 30 db or more. There is no multiplexing or other division of the video signals, and there is nothing in the circuitry which is unfamiliar to the video industry. It is obvious, then, that the uses of the equipment in applications entirely outside television are many, indeed. But even inside the TV industry we may be tempted to assume too much too soon. As a substitute for the "Hot Kine" process, Videotape has immediate advantages both in quality improvement and cost reduction. But in the studio, whether station or production lot, there are many problems, some of them inherent in the process, to overcome. Videotape will be capable of editing and splicing like audio tape recordings. Tapes will be interchangeable from machine to machine. Within broad limits, tape stretch and shrink will not alter either program timing or quality. Tapes can be erased and new material then recorded, many many times. Tapes can be copied from one machine to another.

However, so much of the machinery and electronics is common to both record and playback functions that no substantial cost reduction is in sight for a playback-only machine, and, indeed, no production is planned for equipment solely for playback purposes. This means the tie-up of a comparatively costly machine for editing purposes only — a machine which might otherwise be earning its cost in time-delay service. The Videotape recorder provides 320-line resolution with completely imperceptible gray-scale distortion, and gives, therefore, reproduction on the TV screen which is virtually indistinguishable from live TV. This is also true of the long-neglected soundtrack. It will do so immediately after recording and without any processing whatever. This makes it ideal for time delay of whole programs, unedited. The relatively small size of the one-hour tape reel also makes the machine potentially of great usefulness in rushing special-events broadcasts from points out of direct video contact with the studio — but even this use must await experience in the studio this Fall, and the construction of such special truck facilities as may be needed to house and power the machine. After the Fall tests in the broadcast studios, we will know far better how to exploit the special capabilities of Videotape. During these months we have been invited by both NBC and CBS to participate in the applications experiments.

All of us expect next year's production

machines to benefit greatly from the factory-studio engineering program this Fall, and we know that many of the standards which we are now deliberately leaving *open*, will be ready for resolution then. We recognize, of course, that standards are set by practice. We also recognize the danger of freezing practice too early, and thus of establishing standards which we may all regret at a later time. That is why all of us expect production VTR machines to differ considerably from the prototypes, and why we so welcome the networks' willingness to give us their experience in actual operation as a guide to the design we eventually freeze, at least as to operational standards.

There is, for instance, placement of sound versus picture on the tape. It may be possible, as a result of the cooperation of the networks, to approach very closely, even perhaps to reach perfect dead sync. Experience with the prototypes now being made will tell the tale.

Inevitably there arises the question of motion-picture uses for the apparatus. Frankly, we see no immediate application here, and probably very little even in the future. At its very best, video quality is simply not comparable with ordinarily good original film, and not even remotely comparable to the new larger-negative film processes. VTR has come a long way in reaching good video standards. We do not expect it to make the big jump to match high-quality film. Videotape has perhaps one potential application to motion-picture production, however, as a time-saving tool. Shooting a scene with high-quality film, the director must wait for processing to know if the camera got what he wished. He may do a scene over and over, in the hope one take may turn out right. After the processing delay, he still may find no take with which he is satisfied, and then must expensively reassemble cast and set. It might be possible to shoot simultaneously in film and in Videotape, then review immediately the tape recording. Among many other problems, those of assuring identical lens and picture registration would have to be solved. This procedure could reduce production time and costs in motion pictures — but any speculation on the replacement of the 35 mm camera by Videotape is, in our belief, foolish at this time.

There is, finally, the question of color. The machines which now exist will not satisfactorily record and reproduce color transmissions, despite their frequency response. There is, however, *no limitation whatever* in the operating principles of the VR-1000 which will prevent their use for color. As already stated, development has not stopped even on the prototype machines which the networks will have this fall. A large part of our current program is the realization of color recording in hardware — that realization exists now in principle.

A new rapid processor for TV news films has been announced by the E.D.L. Co., 5929 East Dunes Hwy., Gary, Ind. This D.M. 12-1 was recently described at the

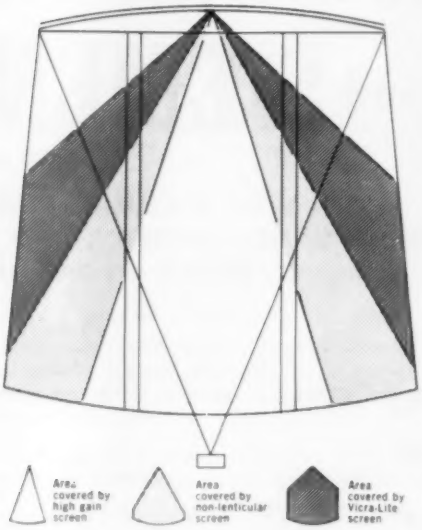
Society's Spring Convention. Film processing time is 40 sec dry to dry at a rate of 36 ft/min, using either Eastman or Du Pont pre-hardened film. Capable of conversion to continuous operation for video recording purposes, it has a synchronous motor drive pacing the machine to an exact speed of 36 ft/min. It may be used with storage elevators. Overall dimensions of the equipment are 56½ in. high, 38⅝ in. long and 15 in. deep. Weight is approximately 500 lb.

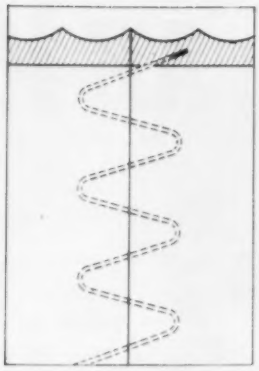
A dead-sync magnetic sound editor has been announced by the E. W. D'Arcy & Assoc., Box 1103, Ogden Dunes, Gary, Ind. The device is a self-contained, picture viewer, sound reader and amplifier in the same en-

closure. Facilities are provided for either loudspeaker or headset monitoring. This is reported to be the first in a series of such devices This unit is priced at $300.

An orbital magnetic head mount is now produced by E. W. D'Arcy & Assoc., Box 1103, Odgen Dunes, Gary, Ind., for the conversion of cameras and projectors to magnetic sound. The mount was described at the Spring Convention of the SMPTE. It is reported to make possible all of the critical alignment adjustments without affecting magnetic head film contact.

Typical seating plan showing comparison of optimum light distribution of non-lenticular, high-gain and Vicra-lite screens



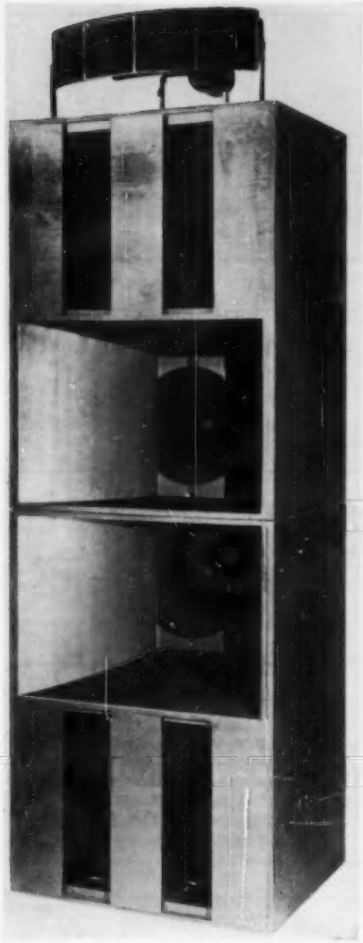


The Vicra-Lite Screen has been announced by L. E. Carpenter & Co., Empire State Bldg., New York 1, N.Y. Designed according to the principles depicted above, this embossed screen is made wholly of vinyl fabric chosen to provide a screen of great strength and durability and one of minimum susceptibility to damage in cleaning and handling. The lenticulated surface is designed for optimum light distribution and reflection. The seams are accomplished by a patented process called Nichro-Weld which is reported to make seams invisible to any part of the audience.

The X-Y Mount is a product of Photographic Analysis Co., 100 Rock Hill Rd., Clifton, N.J. When placed between tripod and camera the mount enables the photographer to move the camera left or right or backwards or forwards by turning a knob. It is possible to move the camera as little as 0.0078 in. per quarter turn, or it can be moved a full inch from the central starting point. The X-Y Mount will fit all tripods and cameras, but has been especially designed for use with the Eastman Kodak High-Speed camera, and the Wollensack Fastax camera. There are three models for varying camera holes and tripod mount screws.

The Hollywood Camera Company is a new firm specializing in all types of photographic equipment. Sales are both retail and by direct mail. The firm handles U.S. government surplus cameras, film and paper and other photographic items. It is located at 10615 Chandler Blvd., North Hollywood, Calif.

Westrex Corp., New York, recently announced its new line of Standard multichannel and single-channel sound systems for motion-picture theaters. The Standard line uses the same R10 stereophonic magnetic reproducer and R6 photographic



reproducer as the Westrex line of sound systems described in the March *Journal* (p. 190). The preamplifier cabinet (51B) and control cabinet (52A) for multichannel systems are also the same in both lines. Where the Westrex line amplifier cabinets housed up to four 27-type 60-w power amplifiers, however, the Standard line uses a similar number of 26-type 30-w amplifiers. In the single-channel systems the same control cabinet (48A) is used, but the transmission cabinet in the Standard line is type 47 (instead of 49 as in the Westrex line). This type 47 cabinet is 20 in. high and may be wall or table mounted. The booth monitoring loudspeaker is located inside it and is large enough to permit operation at a relatively low level to be audible in the booth. The Westrex 26-type 30-w amplifier is mounted in the base of this cabinet and is easily removable. Space is provided for an additional 26-type amplifier.

The Standard line uses a type 15 loudspeaker assembly (shown above) featuring the Westrex 713B high-frequency unit and the type 803A low-frequency speaker. The 713B can handle the full output of the Standard multichannel and single-channel systems in the frequency range of 800 to 10,000 cycles and is used with either a 50° or 80° multicellular horn. It has a duralumin diaphragm in an oversized permanent magnet.

Professional Services

employment service

These notices are published for the service of the membership and the field. They are inserted three months, at no charge to the member. The Society's address cannot be used for replies.

Positions Wanted

Film Buyer or Sales. Ten years experience in industrial films. Desire position in Italy. Resume on request. Write: Fred Forma, 8798 16th Avenue, Brooklyn 14, N. Y.

Processing Lab Technician. Seven years with Kodak in Kodachrome processing stations, plus 5 years prior work in stills. Now with small N.Y.C. lab doing quality control and technical service work. Experienced in chemical analysis, solution control, printing and duplicating B & W and color, Eastman Kodak and Ansco materials, including Eastman Kodak positive-negative color, maintenance, construction, production, planning. Charles J. Gudtner, Apt. 225, 611 West 112 St., New York 25.

Audio-Visual Education. B.A. in Industrial Arts Education, formerly Instructor of Motion-Picture Photography, Signal Corps., U.S. Army. Experienced in motion-picture and still photography and TV programming. Background in electronics and high fidelity. Specialist in audio-visual methods and equipment. Complete resume upon request. William J. Ryan, Route 1, Sy Road, Niagara Falls, N.Y.

Motion Picture and Still Photographer. College graduate, B.S. biology. Experienced medical photographer, all phases black-and-white, color scientific photo., with knowledge and use of various cine and still equipment. Varied free-lance assignments. Attending City Coll. N. Y. Film Institute. Desires position with organization in metropolitan New York. George L. Wasser, 1845 Phelan Place, New York 53.

Positions Available

16mm Laboratory Technician to take over operation and responsibility of reversal processing laboratory. Must be capable of taking full charge; know emulsions and chemicals, and maintenance of Houston Model 22 machine; and capable of growing with expanding studio. Experience in printing both color and black and white desired. Write full resume, references and salary requirements to Joseph Dephoure, Dephoure Studios, 782 Commonwealth Ave., Boston 15, Mass.

Equipment Sales Representative for inside and outside sales and rentals of professional motion-picture and audio-visual equipment. Thorough experience and knowledge of equipment necessary, must have good sales personality. Write resume, references and salary requirements. Florman & Babb, 68 West 45 St., New York 36.

Equipment Maintenance Man, with thorough experience in Moviolas, amplifiers, projectors, electrical equipment. Write experience, references, salary requirements. Florman & Babb, 68 West 45 St., New York 36.

Motion Picture Assistant. Need young man, graduate college-level motion-picture production course, to assist in all phases production in industrial motion-picture unit. Send complete resume and references including salary requirement to Salaried Personnel Dept., Ford Motor Co., 3000 Schaefer Rd., Dearborn, Mich.

Electronic Engineers. Immediate openings in expanding engineering department for men with experience in fields of TV transmitter and studio equipment, communication transmitters and AM and FM transmitters. Permanent positions, chances for advancement, complete employee benefits. Mail complete details to Personnel Director, Gates Radio Co., Quincy, Ill.

Film Inspectors. Permanent or summer posi, tions open. Telephone or write: Kern Moyse, Peerless Film Processing Corp., 165 W. 46 St.-New York 36.

Cameraman: Duties primarily as 16mm cameraman with some work in sound and editing. College Production unit engaged in producing 16mm color and sound films of an educational nature. Entrance salary $4320/yr. Send resume of background and experience to Norman E. C. Naill, Motion Picture Unit Manager, War Memorial Hall, Blacksburg, Va.

Writer-Editor. Duties primarily as editor and secondarily as writer. Experience in other phases of motion-picture production helpful, but not necessary. College production unit engaged in producing 16mm color and sound films of an educational nature. Entrance salary $4320/yr. Send resume of background and experience to: Norman E. C. Naill, Motion Picture Unit Manager, War Memorial Hall, Blacksburg, Va.

Motion-Picture Unit Director. An unusual opportunity for man to organize and direct a motion-picture unit. He must have experience in animation, slide films and motion pictures. He must be familiar with all types of motion-picture equipment and sources and be able to guide others in the development and execution of industrial training films. Location: St. Louis, Mo.

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News Columns

Advertisers

Meeting Calendar

Acoustical Society of America and 2d Congress of International Commission on Acoustics, June 18–24, IUPAP, Cambridge, Mass.

National Audio-Visual Convention, July 20–25, Hotel Sherman Chicago.

The American Society for Engineering Education, June 25–29, Iowa State College, Ames, Iowa.

Western Electronic Show and Convention, Aug. 21–24, Pan-Pacific Auditorium and Ambassador Hotel, Los Angeles.

Biological Photographic Association, Aug. 27–31, Powers Hotel, Rochester, N. Y.

High-Speed Photography, Third International Congress, including exhibit of high-speed photographic and cinematographic equipment and instrument aids; sponsored by Britain's Dept. of Scientific and Industrial Research, Sept. 10–15, London.

American Society of Mechanical Engineers, Sept. 10–12, Denver.

Theater Owners of America, Inc., Annual Convention, Sept. 19–25, Coliseum, New York.

National Association of Educational Broadcasters, Oct. 16–18, Atlanta.

National Electronics Conference, Inc., 12th Annual Conference, Oct. 1–3, Hotel Sherman, Chicago.

Audio Fair, Oct. 4–7, Hotel New Yorker, New York.

80th Semiannual Convention of the SMPTE, including Equipment Exhibit, Oct. 8-12, Ambassador Hotel, Los Angeles.

Ninth Annual Conference on Electrical Techniques in Medicine and Biology, Nov. 7–9, Governor Clinton Hotel, New York.

81st Semiannual Convention of the SMPTE, including Equipment Exhibit, Apr. 29-May 3, 1957, Shoreham Hotel, Washington, D. C.

82nd Semiannual Convention of the SMPTE, including Equipment Exhibit, Oct. 4-9, 1957, Philadelphia-Sheraton, Philadelphia.

83rd Semiannual Convention of the SMPTE, including Equipment Exhibit, April 21-26, 1958, Ambassador Hotel, Los Angeles.

84th Semiannual Convention of the SMPTE, Oct. 20-24, 1958, Sheraton-Cadillac, Detroit.

85th Semiannual Convention of the SMPTE, including International Equipment Exhibit, May 4-8, 1959, Fontainebleau, Miami Beach.

86th Semiannual Convention of the SMPTE, including Equipment Exhibit, Oct. 6-10, 1959, Hotel Statler, New York.

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